AFGL-TR-88-0014

H A I R M - 8 7
A HIGH ALTITUDE INFRARED RADIANCE MODEL

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HAIRM, the AFGL/Visidyne High Altitude Infrared Radiance Model, calculates atmospheric radiance over the spectral region from 250 to 6000 cm^{-1} (1.67-40.0 μm) and over altitudes from 60 to 250 km. It calculates NLTE (non-local thermodynamic equilibrium) radiation from five atmospheric molecules, CO_2, H_2O, NO, O_3 and CO. The older version, which evolved over many years of analyses and modeling of AFGL field data, consists of eight separate programs or modules which are run individually. This version of the code, HAIRM-87, has linked these programs together under a single MAIN routine and added an interactive input module that prompts the user for the various code inputs. Additionally some proprietary integrating subroutines have been replaced, so that the code can be released to the DoD community (Upon request to AFGL/LSP). HAIRM-87 is identical in model content to the earlier version.

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1. INTRODUCTION

HAIRM, the AFGL/Visidyne High Altitude Infrared Radiance Model, calculates atmospheric radiance over the spectral region from 250 to 6000 cm^{-1} (1.67-40.0 μm).[1-5] Altitudes from 60 to 250 km are covered, although approximate results are obtained for altitudes down to 50 km and up to 500 km.[1] The code was primarily developed and written by the late Dr. Tom Degges of Visidyne, Inc. and is frequently referred to as the Degges Code. It evolved over twenty years of data analysis and modeling.[2] HAIRM calculates the radiation from five atmospheric molecules, CO_2, H_2O, NO, O_3 and CO; most importantly it includes the effects of non-local thermodynamic equilibrium (NLTE), which is the dominant type of atmospheric radiation at these altitudes. Because of the rarefied conditions, molecules that are in excited states due to either solar pumping, chemical formation or earthshine pumping are unable to undergo enough collisions to relax from these excited states before they radiate, i.e. their collisional lifetimes are longer than their radiative lifetimes. This is the basis for NLTE radiation. HAIRM uses standard atmospheric profiles to calculate the altitude distributions of excited states under either daytime or nighttime conditions. It then calculates

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1. T. C. Degges and A. P. D'Agati, "A User's Guide to the AFGL/Visidyne High Altitude Infrared Radiance Model Computer Program," Rpt. No. AFGL-TR-85-0015, Air Force Geophysics Laboratory, Hanscom AFB, MA 01731 (October 1984). ADA161432
2. V. L. Corbin, A. Dalgarno, T. C. Degges, F. B. House, P. Lilienfeld, G. Ohring, and G. E. Oppel, "Atmospheric Radiance Models for Limb-Viewing Geometry in the Five-to-Twenty-Five Micron Spectral Region," Rpt. No. AFCRL-69-0552, Air Force Geophysics Laboratory, Hanscom AFB, MA 01731 (1969). AD868194L
3. T. C. Degges, "A High Altitude Radiance Model," Rpt. No. AFCRL-TR-71-0156, Air Force Geophysics Laboratory, Hanscom AFB, MA 01731 (1972). AD745319
4. T. C. Degges, "A High Altitude Infrared Radiance Model," Rpt. No. AFCRL-TR-74-0606, Air Force Geophysics Laboratory, Hanscom AFB, MA 01731 (1974). ADA008035
5. T. C. Degges and H. J. P. Smith, "A High Altitude Infrared Radiance Model," Rpt. No. AFGL-TR-77-0271, Air Force Geophysics Laboratory, Hanscom AFB, MA 01731 (1977). ADA059242

the spectral radiance from these five molecules and plots the radiances for the desired paths.

This version of the High Altitude Infrared Radiance Model, HAIRM-87, is identical in model content to the previous version, which we will call HAIRM-85.[1] The older version consists of eight separate programs or modules which are run individually to arrive at a complete calculation. The various HAIRM-85 programs, BGND2, BGND3, BGND4, BGND6, BGND7, BGND9, SPCTRA, and TRYPEN, have been linked under a single MAIN program in HAIRM-87. Also a set of proprietary integration routines has been replaced so that the entire code can be made available to the DoD community. HAIRM-87 contains an interactive input module that prompts the user for the various code inputs (including plotting parameters) and prepares the input files needed by the other code modules. Since the calculational models in HAIRM-87 are the same as those in HAIRM-85, the user is directed to reference (1) for more information. This report supplements these and previous HAIRM reports in that it presents details about the linked code, HAIRM-87.

The following sections describe the new input module and the program flow for HAIRM-87. Section 2 discusses the program structure and describes the input variables and supporting data files. Section 3 describes the code's execution, including the new input module. A sample input file and two test cases are given in the Appendices A and B. Appendix C describes the structure of the magnetic tape on which HAIRM-87 is furnished and discusses getting the program operational.

2. PROGRAM STRUCTURE

2.1 Compilation and Linkage

The FORTRAN source code is found in eight files, which contain the following:

1) MAIN — Main driver for HAIRM-87. It includes most of the file handling and program logic flow and controls data transfer between the modules.

2) MOLE — Calculates excited state populations. It includes the HAIRM-85 molecular-profile routines, BGND2(CO_2), BGND3(H_2O), BGND4(NO), BGND5(O_3), and BGND7(CO).

3) BGND9 — Calculates band radiance for limb, horizontal and vertical paths. Same as HAIRM-85 file.

4) SPCTRA — Calculates path spectral radiances. Same as HAIRM-85 file, but now a subroutine.

5) TRYPEN — Plotting package. Same as HAIRM-85 files, but now a subroutine.

6) INLIB — Subroutines for the interactive input module.

7) PROGLIB — HAIRM-85 subroutine library without its plotting routines. Also includes selected LINPACK[6] subroutines as required by BGND2 and BGND6.

8) PLOTLIB — Plotting subroutines from the HAIRM-85 library.

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6. J. J. Dongarra, J. R. Bunch, C. B. Moler, and G. W. Stewart, LINPACK User's Guide, SIAM (1979).

These eight routines must be compiled and linked together. Some system dependent routines required for linkage are summarized in Table I. Modifications may be required in accordance with requirements of the user's system. The plotting subroutines listed in Table II are, except for the plotter initialization call, "CALCOMP standard."

TABLE I. SYSTEM DEPENDENT ROUTINES

- OPEN STATEMENT

NO. OF CALLS	CALLING ROUTINE	MODULE
53	MAIN	MAIN
1	DATLOK	INLIB
2	LOADDE	INLIB
2	DUMPDE	INLIB

- DAY

User must supply system call for date and time. The variable ADATE should contain both the date and time in CHARACTER*32 format.

NO. OF CALLS	CALLING ROUTINE	MODULE
1	DATE	MAIN

TABLE II. EXTERNAL PLOTTING SUBROUTINES

NO. OF CALLS	SUBROUTINE	ARGUMENTS	PURPOSE
1	INITP2	'name',NCHAR,NFILE	
			Opens plot file
		name	Name of plot file to be sent to printer/plotter
		NCHAR	Number of characters in 'name' (Here = 4)
		NFILE	File number for writing any error messages
1	ENDPLT		Terminates plotting and closes plot files
1	FACTOR	PFAC	Sets internal scale factor
		PFAC	Size scaling factor, e.g. 0.5 = half size
20	SYMBOL	X,Y,HITE,ARRAY,THETA,NCHAR	
			Plots an ASCII character string
		X,Y	Lower left coordinates of first character
		HITE	Character height
		ARRAY	Character string being plotted
		THETA	Angle of rotation for character string
		NCHAR	Number of characters in ARRAY
9	NUMBER	X,Y,HITE,RNUM,THETA,NDEC	
			Plots a real number
		X,Y	Coordinates of lower left corner
		HITE	Character height
		RNUM	Real number being plotted
		THETA	Rotation angle for plotted number string
		NDEC	Number of decimal places
			>0 Plot NDEC decimal places
			0 No decimal places, but a decimal point
			-1 Plot integer part only
35	PLOT	X,Y,IPEN	Draws a line or moves the pen
		X,Y	New coordinates relative to current origin
		IPEN	Pen control parameter
			2 Lower pen and move
			3 Raise pen and move
			-2 Lower pen, move and reset origin to x,y
			-3 Raise pen, move and reset origin to x,y

2.2 Input Data Files

The following input files are needed by HAIRM-87:

- The nine model atmospheres:

1)	ATM1976.DAT	1976 Standard Atmosphere
2)	ATM15AN.DAT	15^{o} Latitude Annual
3)	ATM30SM.DAT	30^{o} Latitude Summer
4)	ATM30WN.DAT	30^{o} Latitude Winter
5)	ATM45SP.DAT	45^{o} Latitude Spring/Fall
6)	ATM45SM.DAT	45^{o} Latitude Summer
7)	ATM45WN.DAT	45^{o} Latitude Winter
8)	ATM60SM.DAT	60^{o} Latitude Summer
9)	ATM60WN.DAT	60^{o} Latitude Winter.

The fifty atmospheric profile files in HAIRM-85 have been combined into these nine latitude/season files. Expansion from nine to fifty profiles results from suboptions to the nine basic files, i.e. day/night and exo-atmospheric temperature. HAIRM-87 selects the appropriate profile from the model atmospheres and suboptions chosen by the user.

- The line strength and position file:

  LINE.DAT

- The Band information file:

  BKNEW.DAT

HAIRM includes molecular state bands for CO_2, H_2O, NO, O_3 and CO. The bands used for the radiance calculations are summarized in Table III. A band strength of 10^{-19} $mol^{-1}cm^2cm^{-1}$ has been used to distinguish between strongly and weakly radiating bands.

- The file containing parameter values for the input module:

  DEFLTS.

Two sample DEFLTS files are given with the test cases in Appendix B.

TABLE III. HAIRM BAND DATA [1]

Molecule	Relative Band Strength Strong*	Weak	Number of Bands
CO_2		16-18 μm	2
	14-16 μm		7
		12-14 μm	2
		10.4 μm	1
		9.4 μm	1
		5.2 μm	1
		4.8 μm	1
	4.3 μm		5
	2.7 μm		6
		2 μm	3
H_2O	6.3 μm		3
		4.7 μm	2
		3.2 μm	2
	2.7 μm		4
		2.1 μm	1
	1.9 μm		2
NO	5.3 μm		2
		2.7 μm	1
O_3	14.3 μm		2
		10-12 μm	8
	9-10 μm		9
		5-6 μm	5
	4.7 μm		4
		3.6 μm	1
	3.3 μm		1
CO	4.6 μm		2
		2.4 μm	1

*Strong Bands Have Strength ≥ 10^{-19} $(mol^{-1}cm^2cm^{-1})$.

2.3 Input Variables

Following is a list of the input variables in the DEFLTS data file. The interactive input module prompts the users for these parameters.

CARD	VARIABLE HAIRM-87	VARIABLE HAIRM-85	DESCRIPTION/COMMENTS
1	ACTIVE	-	Interactive/Batch control parameter. = 0 HAIRM-87 runs in batch mode and skips the input module. = 1 HAIRM-87 runs in the interactive mode, which allows the user to update the DEFLTS file. This parameter must be manually changed by the user, i.e. edit the DEFLTS data file.
2	IATMOS	-	Model atmosphere index number. = 1 1976 Standard called ATM1976.DAT = 2 15^{0} Annual called ATM15AN.DAT = 3 30^{0} Summer called ATM30SM.DAT = 4 30^{0} Winter called ATM30WN.DAT = 5 45^{0} Spring/Fall called ATM45SP.DAT = 6 45^{0} Summer called ATM45SM.DAT = 7 45^{0} Winter called ATM45WN.DAT = 8 60^{0} Summer called ATM60SM.DAT = 9 60^{0} Winter called ATM60WN.DAT
	ATNAME	-	Name of atmosphere file, see above.
3	EXOTMP	-	Exo-atmospheric temperature. Each model atmosphere has a set of possible exo-atmospheric temperatures. For atmosphere 1, the only choice is 1000K, while the others have choices of 600, 1000, or 1500K.
	NGHTDY	-	Integer variable used to indicate night(3) or day(4).
	NLTE	NLTE	Integer variable used to indicate conditions of computation. = 1 Local thermodynamic equilibrium = 2 Collisional excitation only = 3 Night conditions = 4 Noon conditions = 5 Include high vibrational temperatures for nitrogen

CARD	VARIABLE HAIRM-87	VARIABLE HAIRM-85	DESCRIPTION/COMMENTS
4	SOLANG	ZFAC	Solar zenith angle. HAIRM-85 input was SEC(SOLANG) = ZFAC. Allowed values of SOLANG range from 0^{o} to 90^{o}.
5	IOBS	NALT	Number of altitudes for which spectra are calculated. Maximum of 11.
6	ALTS()	-	The first five selected altitudes. This array replaces the HAIRM-85 variables KMAX, JTMX, KLMX, JLST and JTDL.
7	ALTS()	-	The remaining selected altitudes.
8	IVIEW()	KA,KB,KC KD,KE	Index for selecting the path type. = 1 Limb (space to space, with alts & tangent height) = 2 Vertical (0^{o}, observer to space) = 3 Horizontal (90^{o}, observer to space) HAIRM-87 retains the HAIRM-85 convention of requiring the same paths types for altitudes 6-10 as for 1-5. Also, altitude 11 is the same path type as altitude 1.
9	NPLT	JMAX	Number of individual plots. Maximum of 11.
	IPLOT	-	Plotting package control variable. = 0 only the plotting package will run. Requires a previously calculated data set. = 1 normal HAIRM-87 execution, uses default file INPEN as the plotting input file.
	NAMNEW	-	Name of plotting file. Required for IPLOT = 0. Defaults to INPEN for IPLOT = 1.
10	ALTPLT()	-	First five altitudes to be plotted.
11	ALTPLT()	-	Remaining plotting altitudes--Up to six.

CARD	VARIABLE		DESCRIPTION/COMMENTS
	HAIRM-87	HAIRM-85	
12	XBCD	XBCD	Title of abscissa.
	NXL	NXL	Number of characters in XBCD. Maximum of 50 characters.
13	SX	SX	Length of abscissa in inches.
	WMIN	WMIN	Lower wavenumber for plot (Minimum is 250 cm^{-1})
	WMAX	WMAX	Upper wavenumber for plot (Maximum is 6000 cm^{-1})
	DELM	DELM	Lower extension to abscissa (no data).
	DELP	DELP	Upper extension to abscissa (no data).
	LW	LW	= 0 Abscissa in wavenumbers (cm^{-1}) = 1 Abscissa in wavelengths (micron)
14	YBCD	YBCD	Title of ordinate.
	NYL	NYL	Number of characters in YBCD; maximum is 50.
15	SY	SY	Length of ordinate in inches.
	LL	LL	= 0 Logarithmic ordinate scale. = 1 Linear ordinate scale.
	LPHOT	LPHOT	= 0 Ordinate in power (Watts/cm**2/sr/XX) = 1 Ordinate in photons (photons/sec/cm**2/sr/XX)
	LCYCLE	LCYCLE	> 0 If LL=0, no more than LCYCLE ordinate cycles. = 0 If LL=0, uses minimum value to determine number of cycles. < 0 If LL=0, uses exactly LCYCLE ordinate cycles. = 1 If LL=1, same ordinate scale for all plots. ≠ 1 If LL=1, ordinate scale is determined for each plot.
16	IDENT	IDENT	Title of plots. Maximum of 50 characters.
	PFAC	PFAC	Overall scale factor.
	ISMP	ISMP	> 0 Only single plot with NPLT curves.
17	IVPLT()	-	Path type index for plotted curves.

CARD	VARIABLE		DESCRIPTION/COMMENTS
	HAIRM-87	HAIRM-85	
18	ICHEK	ICHEK	Print optical thickness. = 0 No = 1 Yes
	IBGND	-	Keep optional file containing vibrational populations. Must be yes(1) if ICHEK=1. = 0 No = 1 Yes
	ICOOL	ICOOL	Print cooling or heating rates. = 0 No = 1 Yes
	IBGND9	-	Keep optional file containing intermediate results from the line-of-sight calculations. = 0 No = 1 Yes
	ISPCTR	-	Keep optional file containing spectral radiance output from 250 to 6000 cm^{-1}. = 0 No = 1 Yes
	ITRY	-	Keep optional file containing plotting output. = 0 No = 1 Yes

3. PROGRAM EXECUTION

3.1 The Input Module

The overall program flow in HAIRM-87 is shown in Fig. 1. The input module, which is used to interactively change input parameters found in the DEFLTS file, is derived from other ones currently used at AFGL. The parameters necessary to run the HAIRM calculations, which include calculations of NLTE profiles, spectral radiances and a plotting file, are stored in DEFLTS. Sample files are given in Appendix B. If DEFLTS is not found, a set of values contained in subroutine LOADDE is used. Any or all of the HAIRM inputs (excluding the one governing batch execution) can be changed with the interactive input module. After model parameters have been selected, HAIRM-87 exits the input module and either continues execution or exits (so it can be run in batch mode). In either case DEFLTS is updated with the new values of the input parameters.

In order to run HAIRM-87 in the batch mode, the first variable in DEFLTS must be changed from 1 to 0. This is the only change to DEFLTS that must be accomplished by directly editing the file. Experienced users may find it more efficient to just edit DEFLTS rather than using the input module menus to change input parameters.

Since Appendix A contains a complete example of an interactive session, only a brief explanation is given here. The input module starts by displaying the following menu with numbered choices:

```
REVIEW OR MODIFY INPUT PARAMETERS

1.   MODEL ATMOSPHERE
2.   SOLAR ZENITH ANGLE
3.   OBSERVER GEOMETRY
4.   PLOTTING AND SPECTRAL PARAMETERS
5.   OUTPUT CONTROL
6.   UPDATE DEFAULT FILE AND EXIT

ENTER NUMBER OF ITEM TO BE CHANGED
0 TO CONTINUE
```

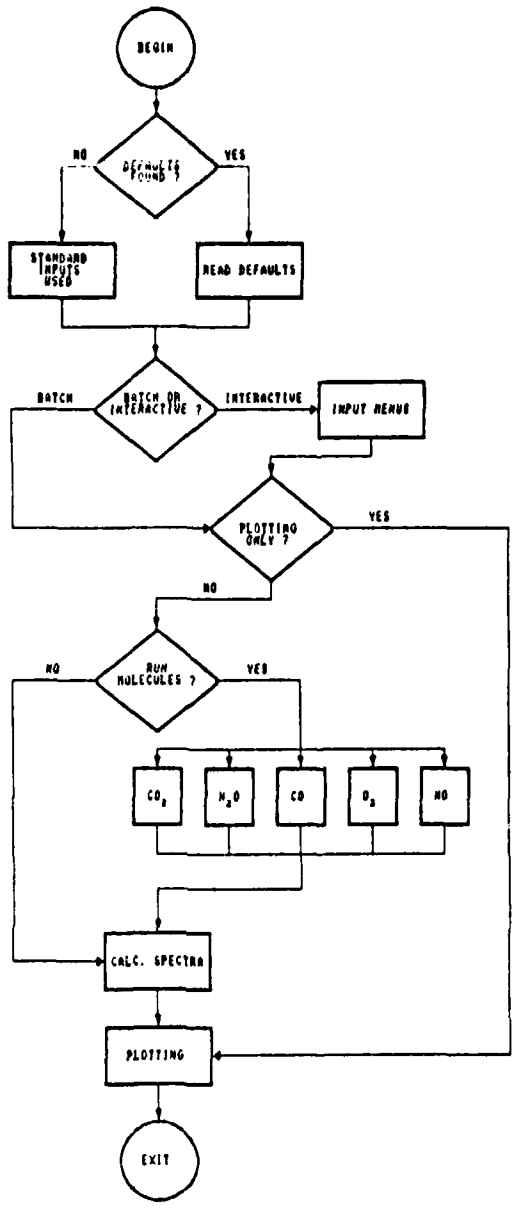

Figure 1. Flow Chart for HAIRM-87 Showing Linkage of the Modules.

This is the top level menu. The user now can select "1" to review or modify the selected model atmosphere, "2" to review or modify the desired solar zenith angle, "3" to review or modify the desired observer geometry, which includes altitude and path type of interest, "4" to review or modify plotting parameters, "5" to select optional output files to be saved, "6" to update DEFLTS file and exit HAIRM-87 for a batch run, or a "0" to continue with execution. All menus have this basic form. A non-zero input to the menu means the user wants to review or modify a variable, while a "0" entry means he wants the program to continue execution. Since some menus are several

layers deep, a "0" often means returning the user to the next higher layer of menus. An example of a two-layer depth is encountered when a "2" is selected in the above example, leading to the following prompt:

```
2.0  REVIEW OR MODIFY SOLAR ZENITH ANGLE:

1.   CURRENT SOLAR ZENITH ANGLE = 10.0

INPUT:  0 TO KEEP CURRENT SOLAR ZENITH ANGLE
        1 TO INPUT NEW SOLAR ZENITH ANGLE
```

Inputing a "0" at this point will return the user to the main menu from this submenu. While inputing "1" results in the prompt

```
INPUT SOLAR ZENITH ANGLE:
```

The user then inputs the new value for the solar zenith angle, the above menu is repeated with the new value of the angle, the interactive session proceeds to the first-level menu when the user gives a "0" input.

3.2 HAIRM-87 Execution

Following an interactive session with the input module and creation of a new DEFLTS file, the first code decision is whether the plotting-only option has been selected (see Fig. 1). If this is the case, only the plotting package, TRYPEN, executes (using a plot data set identified by the user). This data set must have the same format as the data set generated by subroutine SPCTRA.

If the plotting-only option has not been selected, the program follows the calculational sequence of HAIRM-85. This is illustrated in Figs. 2 and 2A. It opens the file INSPEC and determines if it is necessary to execute BGND2, BGND3, BGND4, BGND6, BGND7 and BGND9 in order to calculate profiles for the five molecules. These modules do not need to be rerun if the atmospheric profile is unchanged from the previous run; the key parameters are solar zenith angle, atmospheric model, exo-atmospheric temperature, nighttime/daytime option, and the NLTE variable. Skipping these modules can save 80-90% of the execution time required for a full HAIRM-87 calculation.

When the INSPEC file must be recalculated because one or more of these parameters have changed, the five BGNDx modules, where x = 2, 3, 4, 6, and 7, execute. Figure 2 shows the various input and output files and also illustrates the radiance calculation for each molecule. Each module reads and checks the input data for its respective molecule. It then calculates the vibrational population, optical thickness and volume emission rates for all of that molecule's bands.(1) The HAIRM-87 modules, which have the same name as their HAIRM-85 counterparts, are:

Molecule	Module
CO_2	BGND2
H_2O	BGND3
NO	BGND3
O_3	BGND6
CO	BGND7.

The first step in the BGNDx execution is the formation of its INPUT file. This file is created by the program and includes the user selected atmosphere and BKNEW.DAT. The input/output file flow is shown in Figs. 2 and 2A. As shown in Fig. 2, three output files are generated by each of the BGNDx routines. The OUTx file is an optional output file that contains diagnostic information. The user can also have the atmospheric cooling rates and optical thicknesses included in this file. The INBG9.xA and INBG9.xB files are needed as input to BGND9. BGND9 calculates the radiance for two endo-atmospheric viewing paths (horizontal and vertical) and one exo-atmospheric path (limb).

HAIRM-87 follows its predecessor by executing BGND9 after completion of each molecular module. BGND9 calculates radiance values, mean temperature and number of molecules for the three allowed paths. These paths which are calculated for each altitude (ALTS) are:(1)

> Exoatmospheric limb viewing with ALTS = tangent altitude;
> Horizontal path from ALTS to space; and
> Vertical path from ALTS to space.

These paths are illustrated in Fig. 3. Output from BGND9 includes the optional file OUT9.x and INSPEC.x. After running the BGNDx routines and BGND9 five times, the temporary files INBG9.xA, and INBG9.xB are deleted. The five INSPEC.x files are combined into a file called INSPEC and then deleted. These file manipulations are done by MAIN without user intervention.

INPUT/OUTPUT FILES

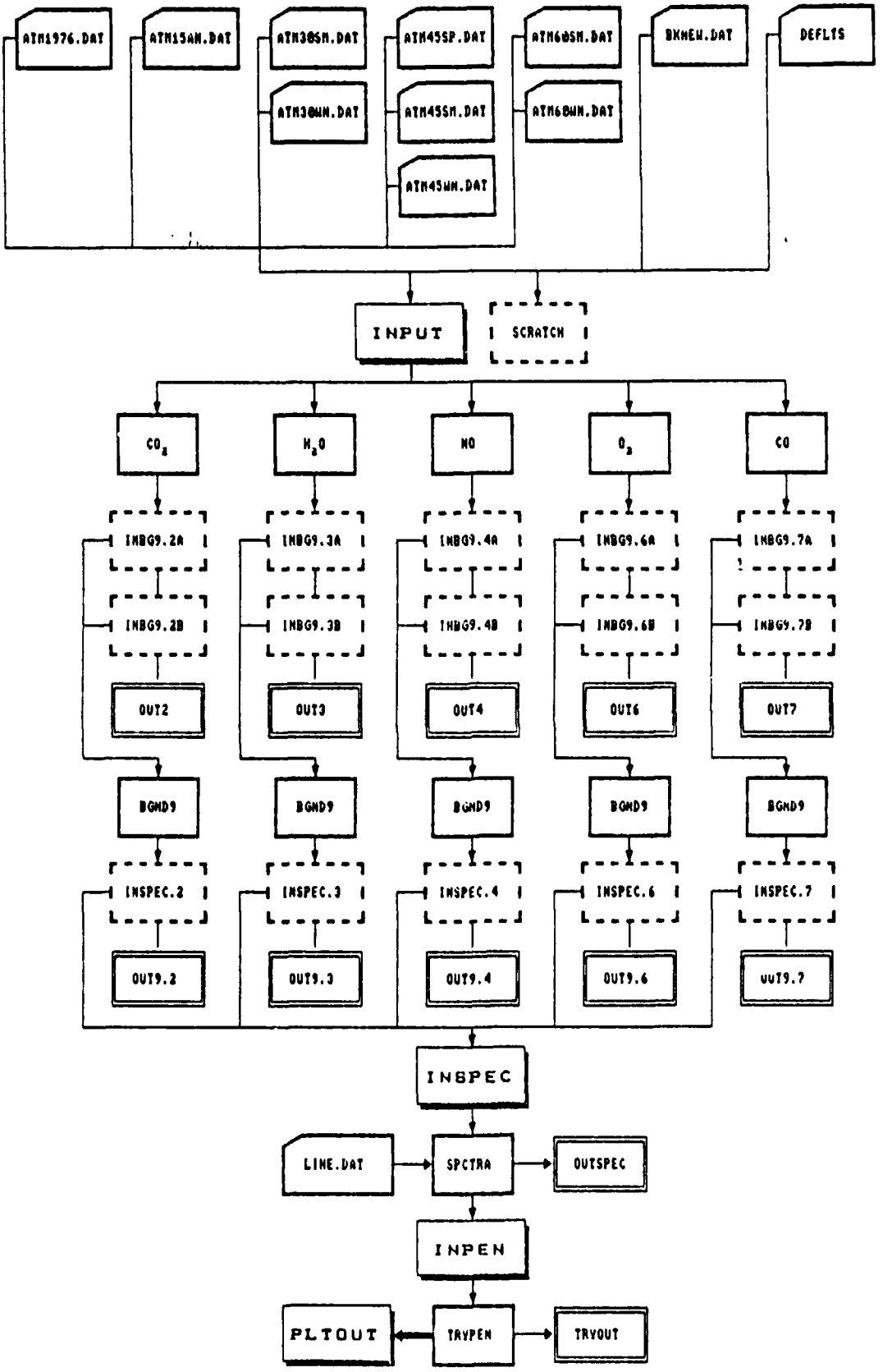

Figure 2. Flow Diagram Symbol Table.

FLOW DIAGRAM SYMBOL TABLE

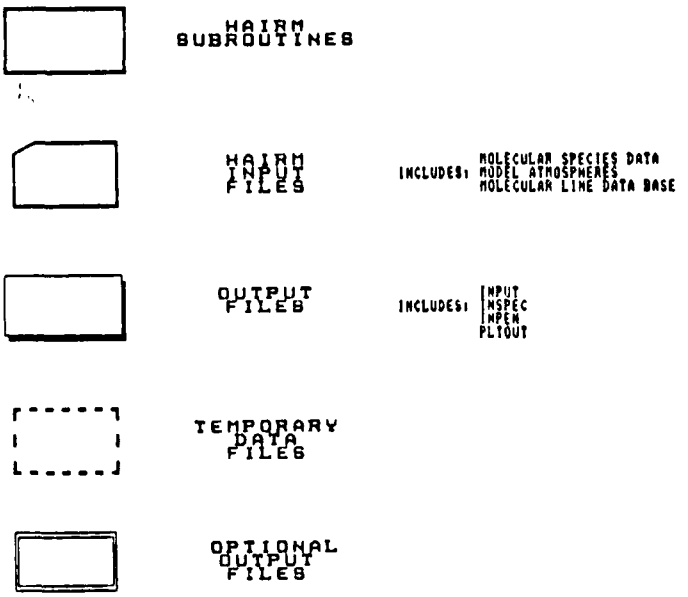

Figure 2A. Input and Output Files for HAIRM-87.

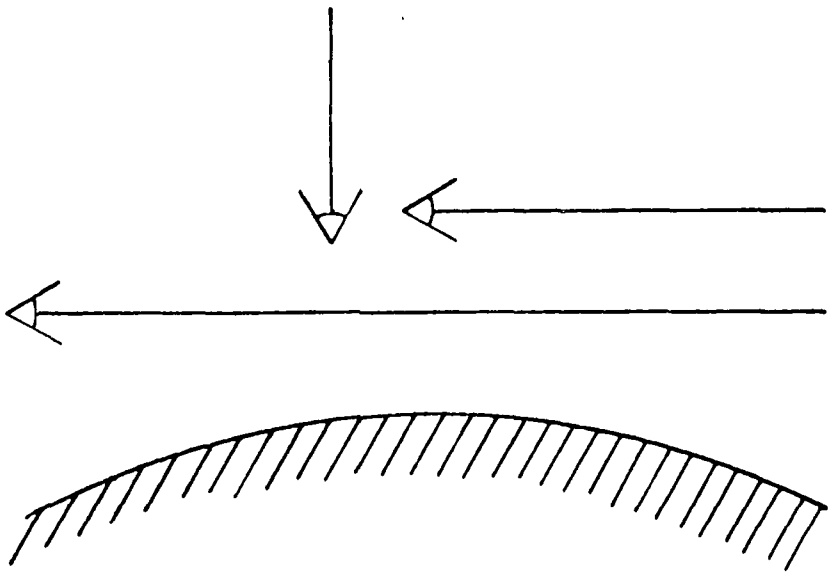

Figure 3. Schematic Showing the Three Paths Allowed by HAIRM: Limb (Space to Space), Vertical (Observer to Space) and Horizontal (Observer to Space).

At this point two output files are for further execution, but up to twelve files may have resulted if various optional output files are saved. The two required files are:

INPUT which provides input data to the BGNDx modules; and

INSPEC which contains output from these BGNDx modules and input for the SPCTRA module.

The SPCTRA module calculates the spectral radiance for the atmospheric path types selected by the user. It requires two input files, INSPEC and LINE.DAT. The latter file contains a compilation of line positions and strengths. The spectral radiance is calculated for the full interval from 250 cm^{-1} to 6000 cm^{-1} for each requested altitude. The resulting spectral radiances are put into the optional file OUTSPEC and required file INPEN.

Finally the plotting module, TRYPEN, is run to obtain spectral radiance plots. It reads either the data in INPEN or those from a previous calculation in a file designated by the user. The output from TRYPEN includes a plotting file, PLTOUT, and an optional output file called TRYOUT.

In summary, if none of the optional output files are saved, the final output consists of the files INPUT, INSPEC, INPEN, PLTOUT plus all the original input files. The complete Input/Output file flow is shown in Fig. 2. The external files used by the various HAIRM-87 modules are listed in Table IV.

TABLE IV. EXTERNAL FILES IN HAIRM-87 MODULES*

- MAIN

UNIT	NAME	DESCRIPTION
5	INSPEC	File calculated by BGND9 is opened to see if IATMOS, EXOTMP, NGHTDY, NLTE or SOLANG have been changed. If they are unchanged, the five BGND routines for the individual molecules are skipped.
5	INSPEC.X	Files from five BGND9 runs are opened and merged into one file called INSPEC. X=2,3,4,6,7
16	INSPEC	Opened for merging of INSPEC.X files.

- INPUT

UNIT	NAME	DESCRIPTION
4	SCRATCH	Temporary scratch file opened in LOADDE.

10	DEFLTS	File containing input parameters for executing HAIRM. This file is updated by the interactive input module. Opened in LOADDE and DUMPDE.
20	"NAME"	This file contains plotting data and is opened in DATLOK.

- BGND2 (CO_2)

UNIT	NAME	DESCRIPTION
3	INBG9.2A	Temporary file holds part of the output from BGND2 for input to BGND9.
4	INBG9.2B	Temporary file holds part of the output from BGND2 for input to BGND9.
5	INPUT	File contains atmosphere and molecule information.
16	OUT2	Optional output file.

- BGND3 (H_2O)

UNIT	NAME	DESCRIPTION
3	INBG9.3A	Temporary file holds part of the output from BGND3 for input to BGND9.
4	INBG9.3B	Temporary file holds part of the output from BGND3 for input to BGND9.
5	INPUT	File contains atmosphere and molecule information.
16	OUT3	Optional output file.

- BGND4 (NO)

UNIT	NAME	DESCRIPTION
3	INBG9.4A	Temporary file holds part of the output from BGND4 for input to BGND9.
4	INBG9.4B	Temporary file holds part of the output from BGND4 for input to BGND9.
5	INPUT	File contains atmosphere and molecule information.
16	OUT4	Optional output file.

- BGND6 (O_3)

UNIT	NAME	DESCRIPTION
3	INBG9.6A	Temporary file holds part of the output from BGND6 for input to BGND9.
4	INBG9.6B	Temporary file holds part of the output from BGND6 for input to BGND9.
5	INPUT	File contains atmosphere and molecule information.
16	OUT6	Optional output file.

- BGND7 (CO)

UNIT	NAME	DESCRIPTION
3	INBG9.7A	Temporary file holds part of the output from BGND7 for input to BGND9.
4	INBG9.7B	Temporary file holds part of the output from BGND7 for input to BGND9.
5	INPUT	File contains atmosphere and molecule information.
16	OUT7	Optional output file.

- BGND9

UNIT	NAME	DESCRIPTION
3	INSPEC.X	Temporary file which holds output from BGND9 for input to SPCTRA. X=2,3,4,6,7
5	INBG9.XA	Temporary file holding part of output from BGNDx for input to BGND9.
15	INBG9.XB	Temporary file holding part of output from BGNDx for input to BGND9.
16	OUT9.X	Optional output file. X=2,3,4,6,7

- SPCTRA

UNIT	NAME	DESCRIPTION
1	INSPEC	Input for SPCTRA. Contains combined output from five INSPEC.x files.
2	OUTSPEC	Optional output file.
4	INPEN	Standard SPCTRA output file. Contains input data for TRYPEN.
5	LINE.DAT	Line information necessary for SPCTRA.

- TRYPEN

UNIT	NAME	DESCRIPTION
2	INPEN	File calculated by SPCTRA containing plot data.
6	TRYOUT	Optional output file.
?	PLTOUT	Plot file for SSI's pltgen program.

---

* Note: The majority of units are actually opened in MAIN. This listing shows where the routines are accessed.

4. REFERENCES

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2. V. L. Corbin, A. Dalgarno, T. C. Degges, F. B. House, P. Lilienfeld, G. Ohring, and G. E. Oppel, "Atmospheric Radiance Models for Limb-Viewing Geometry in the Five-to-Twenty-Five Micron Spectral Region," Rpt. No. AFCRL-69-0552, Air Force Geophysics Laboratory, Hanscom AFB, MA 01731 (1969). AD868194L

3. T. C. Degges, "A High Altitude Radiance Mo el," Rpt. No. AFCRL-TR-71-0156, Air Force Geophysics Laboratory, Hanscom AFB, MA 01731 (1972). AD745319

4. T. C. Degges, "A High Altitude Infrared Radiance Model," Rpt. No. AFCRL-TR-74-0606, Air Force Geophysics Laboratory, Hanscom AFB, MA 01731 (1974). ADA008035

5. T. C. Degges and H. J. P. Smith, "A High Altitude Infrared Radiance Model," Rpt. No. AFGL-TR-77 0271, Air Force Geophysics Laboratory, Hanscom AFB, MA 01731 (1977). ADA059242

6. J. J. Dongarra, J. R. Bunch, C. B. Moler, and G. W. Stewart, LINPACK User's Guide, SIAM (1979).

APPENDIX A

SAMPLE INTERACTIVE INPUT SESSION

The next few pages present an illustrative interactive run using the new HAIRM input module. The prompts from the program are capitalized. Sample inputs from the user are preceded by the >> symbol. Notes have been added throughout the sample session to add clarification to the prompts.

Begin session:

The main routine reads the default input data set from DEFLTS. If this file is not found a set of reasonable values contained in routine LOADDE are used. Input parameters can be changed by selecting the appropriate topic from the menu below. In this session 'DEFLTS was found and we will be changing many of the values.

```
  HIGH ALTITUDE INFRARED RADIANCE MODEL



  REVIEW OR MODIFY INPUT PARAMETERS

  1. MODEL ATMOSPHERE
  2. SOLAR ZENITH ANGLE
  3. OBSERVER GEOMETRY
  4. PLOTTING AND SPECTRAL PARAMETERS
  5. OUTPUT CONTROL

  6. UPDATE DEFAULT FILE AND EXIT

  ENTER # OF ITEM TO BE CHANGED
  0 TO CONTINUE HAIRM EXECUTION
 >>1
```

Inputing "1" activates the menu for model atmosphere input parameters.

```
  1.0 REVIEW OR MODIFY INPUT MODEL ATMOSPHERE...

     CURRENT VALUES ARE:
  1. ATMOSPHERE # 3 CALLED ATM30SM.DAT
  2. EXO-ATMOSPHERIC TEMPERATURE (K):    600.0
  3. NIGHT(3) OR DAYTIME(4):    4
  4. NLTE VARIABLE: 4
```

The current atmospheric model is the 30^0 latitude daytime summer model with an exo-atmospheric temperature of 600K.

```
  ENTER # OF ITEM TO BE CHANGED
  0 TO CONTINUE
```

```
>>1
  POSSIBLE ATMOSPHERES :
  1.   1976 STANDARD
  2.   15 DEG. ANNUAL
  3.   30 DEG. SUMMER
  4.   30 DEG. WINTER
  5.   45 DEG. SPRING/FALL
  6.   45 DEG. SUMMER
  7.   45 DEG. WINTER
  8.   60 DEG. SUMMER
  9.   60 DEG. WINTER
  SELECT ATMOSPHERE :
>>1
     CURRENT VALUES ARE:
  1. ATMOSPHERE # 1 CALLED ATM1976.DAT
  2. EXO-ATMOSPHERIC TEMPERATURE (K):    600.0
  3. NIGHT(3) OR DAYTIME(4):    4
  4. NLTE VARIABLE: 4

  ENTER # OF ITEM TO BE CHANGED
  0 TO CONTINUE
>>2
  POSSIBLE EXO-ATMOSPHERIC TEMPERATURES (K):
   1000.0

  INPUT EXO-ATMOSPHERIC TEMPERATURE (K):
>>1000
     CURRENT VALUES ARE:
  1. ATMOSPHERE # 1 CALLED ATM1976.DAT
  2. EXO-ATMOSPHERIC TEMPERATURE (K):    1000.0
  3. NIGHT(3) OR DAYTIME(4):    4
  4. NLTE VARIABLE: 4

  ENTER # OF ITEM TO BE CHANGED
  0 TO CONTINUE
>>3
  INPUT NIGHT(3) OR DAYTIME(4)  :
>>3

We have just selected nighttime conditions.
     CURRENT VALUES ARE:
  1. ATMOSPHERE # 1 CALLED ATM1976.DAT
  2. EXO-ATMOSPHERIC TEMPERATURE (K):    1000.0
  3. NIGHT(3) OR DAYTIME(4):    3
  4. NLTE VARIABLE: 3

We have now selected the nighttime 1976 standard atmospheric model
with a 1000K exo-atmospheric temperature.
```

```
  ENTER # OF ITEM TO BE CHANGED
  0 TO CONTINUE
>>0

Going back to main menu.



  REVIEW OR MODIFY INPUT PARAMETERS

  1. MODEL ATMOSPHERE
  2. SOLAR ZENITH ANGLE
  3. OBSERVER GEOMETRY
  4. PLOTTING AND SPECTRAL PARAMETERS
  5. OUTPUT CONTROL

  6. UPDATE DEFAULT FILE AND EXIT

  ENTER # OF ITEM TO BE CHANGED
  0 TO CONTINUE HAIRM EXECUTION
>>2

Selecting "2" activates solar angle input module.



  2.0 REVIEW OR MODIFY SOLAR ZENITH ANGLE:

  1. CURRENT SOLAR ZENITH ANGLE =  10.0


  INPUT : 0 TO KEEP CURRENT SOLAR ZENITH ANGLE
          1 TO INPUT NEW SOLAR ZENITH ANGLE
>>1
  INPUT SOLAR ZENITH ANGLE:
>>5

  1. CURRENT SOLAR ZENITH ANGLE =  5.0

We have just changed the solar angle from 10 to 5 degrees. The solar
    ' angle can range from 0.0 to 90.0.  Note the program will accept
   egers or real number inputs.

  INP  : 0 TO KEEP CURRENT SOLAR ZENITH ANGLE
         1 TO INPUT NEW SOLAR ZENITH ANGLE
>>0

Returning to main menu.
```

```
  REVIEW OR MODIFY INPUT PARAMETERS

  1. MODEL ATMOSPHERE
  2. SOLAR ZENITH ANGLE
  3. OBSERVER GEOMETRY
  4. PLOTTING AND SPECTRAL PARAMETERS
  5. OUTPUT CONTROL

  6. UPDATE DEFAULT FILE AND EXIT

  ENTER # OF ITEM TO BE CHANGED
  0 TO CONTINUE HAIRM EXECUTION
>>3

Selecting observer geometry input module.


  3.0 REVIEW OR MODIFY OBSERVER GEOMETRY:

  1. NUMBER OF ALTITUDES : 4

     CURRENT ALTITUDES AND PATH TYPES:

 # 1 ALTITUDE = 80.0 KM AND LIMB        VIEW
 # 2 ALTITUDE = 90.0 KM AND VERTICAL    VIEW
 # 3 ALTITUDE = 100.0 KM AND LIMB        VIEW
 # 4 ALTITUDE = 100.0 KM AND HORIZONTAL VIEW

These three altitudes and four path geometries were found in the
DEFLTS file.  When any input parameter is changed DEFLTS is updated
with the new values.
```

```
  ENTER CHOICE, 0 TO CONTINUE
>>1

To change the number of altitudes input "1".

  INPUT NUMBER OF ALTITUDES (MAX. = 11):
>>6

Now 6 altitudes and path types must be selected.
  INPUT 6 ALTITUDES
  INPUT ALTITUDE # 1 IN KM :
>>60
  INPUT PATH TYPE
  1 LIMB , 2 VERTICAL , 3 HORIZONTAL :
>>1
  INPUT ALTITUDE # 2 IN KM :
>>70
  INPUT PATH TYPE
  1 LIMB , 2 VERTICAL , 3 HORIZONTAL :
>>1
  INPUT ALTITUDE # 3 IN KM :
>>80
  INPUT PATH TYPE
  1 LIMB , 2 VERTICAL , 3 HORIZONTAL :
>>1
  INPUT ALTITUDE # 4 IN KM :
>>90.
  INPUT PATH TYPE
  1 LIMB , 2 VERTICAL , 3 HORIZONTAL :
>>1
  INPUT ALTITUDE # 5 IN KM :
>>100
  INPUT PATH TYPE
  1 LIMB , 2 VERTICAL , 3 HORIZONTAL :
>>1
  INPUT ALTITUDE # 6 IN KM :
>>150
  LIMB       VIEW
```

Note that the path type for entry six is forced! HAIRM requires that the path types for entries 6-10 be identical with those from 1-5 and 11 with 1 (eg. 1=6, 2=7, etc.).

```
  1. NUMBER OF ALTITUDES : 6

     CURRENT ALTITUDES AND PATH TYPES:

Six new altitudes are reviewed.

 # 1 ALTITUDE = 60.0 KM AND LIMB        VIEW
 # 2 ALTITUDE = 70.0 KM AND LIMB        VIEW
 # 3 ALTITUDE = 80.0 KM AND LIMB        VIEW
 # 4 ALTITUDE = 90.0 KM AND LIMB        VIEW
 # 5 ALTITUDE = 100.0 KM AND LIMB        VIEW
 # 6 ALTITUDE = 150.0 KM AND LIMB        VIEW


  ENTER CHOICE, 0 TO CONTINUE
>>0

Returning to main menu.


  REVIEW OR MODIFY INPUT PARAMETERS

  1. MODEL ATMOSPHERE
  2. SOLAR ZENITH ANGLE
  3. OBSERVER GEOMETRY
  4. PLOTTING AND SPECTRAL PARAMETERS
  5. OUTPUT CONTROL

  6. UPDATE DEFAULT FILE AND EXIT

  ENTER # OF ITEM TO BE CHANGED
  0 TO CONTINUE HAIRM EXECUTION
>>4



  4.0 REVIEW OR MODIFY PLOTTING PARAMETERS:

  1. PLOTTING PACKAGE CONTROL PARAMETER
     (PLOT PREVIOUSLY CALCULATED DATA)
  2. ALTITUDES TO BE PLOTTED
  3. SPECTRAL RANGE
  4. PLOT FORMAT (ABSCISSA AND ORDINATE)

  ENTER # OF ITEM TO BE CHANGED OR REVIEWED
  0 TO CONTINUE
>>1
```

```
  PLOTTING CONTROL VARIABLE: IPLOT
  WHEN IPLOT = 0, ONLY THE PLOTTING PACKAGE WILL
  EXECUTE. THIS IS USED TO PLOT A DATA SET
  WHICH ALREADY EXISTS.
  IPLOT = 1 WILL PLOT CURRENT HAIRM DATA SET.

  CURRENT VALUE OF IPLOT =  1

  ENTER CHOICE, 1 TO CHANGE VALUE OR 0 TO CONTINUE
>>0



  4.0 REVIEW OR MODIFY PLOTTING PARAMETERS:

  1. PLOTTING PACKAGE CONTROL PARAMETER
     (PLOT PREVIOUSLY CALCULATED DATA)
  2. ALTITUDES TO BE PLOTTED
  3. SPECTRAL RANGE
  4. PLOT FORMAT (ABSCISSA AND ORDINATE)

  ENTER # OF ITEM TO BE CHANGED OR REVIEWED
  0 TO CONTINUE
>>2

  1. CHOOSE ALTITUDES FOR PLOTTING
  2. REVIEW PLOTTING ALTITUDES

  ENTER CHOICE, 0 TO CONTINUE
>>1
```

Any subset of the six altitudes selected earlier can now be selected for plotting.

```
  POSSIBLE ALTITUDES:

 # 1 ALTITUDE = 60.0 KM AND LIMB       VIEW
 # 2 ALTITUDE = 70.0 KM AND LIMB       VIEW
 # 3 ALTITUDE = 80.0 KM AND LIMB       VIEW
 # 4 ALTITUDE = 90.0 KM AND LIMB       VIEW
 # 5 ALTITUDE = 100.0 KM AND LIMB       VIEW
 # 6 ALTITUDE = 150.0 KM AND LIMB       VIEW
```

```
   CHOOSE ALTITUDES FOR PLOTTING

  INPUT ALTITUDE # 1 IN KM (ALT = 0 TO END) :
>>60

 PATH TYPE IS LIMB
```

If two or more path types are selected for the same altitude a menu will give the user a choice of which path to plot.

```
  INPUT ALTITUDE # 2 IN KM (ALT = 0 TO END) :
>>70

 PATH TYPE IS LIMB

  INPUT ALTITUDE # 3 IN KM (ALT = 0 TO END) :
>>80

 PATH TYPE IS LIMB

  INPUT ALTITUDE # 4 IN KM (ALT = 0 TO END) :
>>90

 PATH TYPE IS LIMB

  INPUT ALTITUDE # 5 IN KM (ALT = 0 TO END) :
>>100

 PATH TYPE IS LIMB

  INPUT ALTITUDE # 6 IN KM (ALT = 0 TO END) :
>>0

  1. CHOOSE ALTITUDES FOR PLOTTING
  2. REVIEW PLOTTING ALTITUDES

  ENTER CHOICE, 0 TO CONTINUE
>>2

Review plotting altitudes.

 SELECTED ALTITUDES:
 # 1 ALTITUDE = 60.0 KM AND LIMB        VIEW
 # 2 ALTITUDE = 70.0 KM AND LIMB        VIEW
 # 3 ALTITUDE = 80.0 KM AND LIMB        VIEW
 # 4 ALTITUDE = 90.0 KM AND LIMB        VIEW
 # 5 ALTITUDE = 100.0 KM AND LIMB        VIEW

  1. CHOOSE ALTITUDES FOR PLOTTING
  2. REVIEW PLOTTING ALTITUDES

  ENTER CHOICE, 0 TO CONTINUE
>>0

Return to main plotting menu.
```

```
  4.0 REVIEW OR MODIFY PLOTTING PARAMETERS:

  1. PLOTTING PACKAGE CONTROL PARAMETER
     (PLOT PREVIOUSLY CALCULATED DATA)
  2. ALTITUDES TO BE PLOTTED
  3. SPECTRAL RANGE
  4. PLOT FORMAT (ABSCISSA AND ORDINATE)

  ENTER # OF ITEM TO BE CHANGED OR REVIEWED
  0 TO CONTINUE
>>3

  CURRENT SPECTRAL RANGE :
     WMIN DATA =  800.0
     WMAX DATA =  1200.0

  INPUTS :
     0. TO KEEP SAME VALUES
     1. TO MODIFY SPECTRAL RANGE

  ENTER CHOICE
>>1

Select new spectral range.  All input is done in wavenumbers, but
plots can be in either wavenumbers or wavelength.

  INPUT LOWER WAVENUMBER LIMIT FOR DATA
>>250

  INPUT UPPER WAVENUMBER LIMIT FOR DATA
>>6000

  CURRENT SPECTRAL RANGE :
     WMIN DATA =  250.0
     WMAX DATA =  6000.0

  INPUTS :
     0. TO KEEP SAME VALUES
     1. TO MODIFY SPECTRAL RANGE

  ENTER CHOICE
>>0
```

```
  4.0 REVIEW OR MODIFY PLOTTING PARAMETERS:

  1. PLOTTING PACKAGE CONTROL PARAMETER
     (PLOT PREVIOUSLY CALCULATED DATA)
  2. ALTITUDES TO BE PLOTTED
  3. SPECTRAL RANGE
  4. PLOT FORMAT (ABSCISSA AND ORDINATE)

  ENTER # OF ITEM TO BE CHANGED OR REVIEWED
  0 TO CONTINUE
>>4

  REVIEW OR MODIFY PLOTTING FORMAT...

  1. ABSCISSA FORMAT
  2. ORDINATE FORMAT
  3. GLOBAL FORMAT

  ENTER CHOICE, 0 TO CONTINUE
>>1

  CURRENT ABSCISSA VALUES:

  1. LABEL: WAVELENGTH (MICRONS)
  2. LENGTH (INCHES):  5.0
  3. EXTENDED WAVENUMBER LIMIT FOR AXIS.(NO LINE)
     DELTA FOR WMIN =  0.000000E+00
     DELTA FOR WMAX =  0.000000E+00
  4. UNITS: WAVENUMBER (0) OR WAVELENGTH (1):  1

  ENTER CHOICE, 0 TO CONTINUE
>>1

  INPUT ABSCISSA LABEL
>>WAVENUMBER (1/CM)

  CURRENT ABSCISSA VALUES:

  1. LABEL: WAVENUMBER (1/CM)
  2. LENGTH (INCHES):  5.0
  3. EXTENDED WAVENUMBER LIMIT FOR AXIS.(NO LINE)
     DELTA FOR WMIN =  0.000000E+00
     DELTA FOR WMAX =  0.000000E+00
  4. UNITS: WAVENUMBER (0) OR WAVELENGTH (1):  1

  ENTER CHOICE, 0 TO CONTINUE
>>2

  INPUT ABSCISSA LENGTH IN INCHES
>>5
```

```
  CURRENT ABSCISSA VALUES:

  1. LABEL: WAVENUMBER (1/CM)
  2. LENGTH (INCHES):  5.0
  3. EXTENDED WAVENUMBER LIMIT FOR AXIS.(NO LINE)
     DELTA FOR WMIN =  0.000000E+00
     DELTA FOR WMAX =  0.000000E+00
  4. UNITS: WAVENUMBER (0) OR WAVELENGTH (1):  1

  ENTER CHOICE, 0 TO CONTINUE
>>4

  INPUT 0 FOR WAVENUMBERS (1/CM) OR 1 FOR WAVELENGTH (MICRONS)
>>0

We have selected wavenumbers for the abscissa unit.

  CURRENT ABSCISSA VALUES:

  1. LABEL: WAVENUMBER (1/CM)
  2. LENGTH (INCHES):  5.0
  3. EXTENDED WAVENUMBER LIMIT FOR AXIS.(NO LINE)
     DELTA FOR WMIN =  0.000000E+00
     DELTA FOR WMAX =  0.000000E+00
  4. UNITS: WAVENUMBER (0) OR WAVELENGTH (1):  0

  ENTER CHOICE, 0 TO CONTINUE
>>0

Return to plot format menu.
  1. ABSCISSA FORMAT
  2. ORDINATE FORMAT
  3. GLOBAL FORMAT

  ENTER CHOICE, 0 TO CONTINUE
>>2

  CURRENT ORDINATE VALUES:

  1. LABEL: RADIANCE (W/sr/cm**2/cm-1)
  2. LENGTH (INCHES):  5.0
  3. LOGARITHMIC (0) OR LINEAR (1) SCALE:  0
  4. UNITS: POWER (0) OR QUANTA (1):  0

  ENTER CHOICE, 0 TO CONTINUE
>>0
```

```
Current ordinate values will be used. No changes were necessary.

  1. ABSCISSA FORMAT
  2. ORDINATE FORMAT
  3. GLOBAL FORMAT

  ENTER CHOICE, 0 TO CONTINUE
>>3

  CURRENT GLOBAL PLOTTING PARAMETERS:

  1. TITLE:    HAIRM PREDICTION - O3 AT 80 KM (NIGHT)
  2. SCALING FACTOR:  1.0
  3. INPUT NON-ZERO NUMBER FOR COMBINATION PLOT ONLY
     CURRENT VALUE IS  0

  ENTER CHOICE, 0 TO CONTINUE
>>1

  INPUT TITLE
 >> TEST CASE NUMBER 1

  CURRENT GLOBAL PLOTTING PARAMETERS:

  1. TITLE:   TEST CASE NUMBER 1
  2. SCALING FACTOR:  1.0
  3. INPUT NON-ZERO NUMBER FOR COMBINATION PLOT ONLY
     CURRENT VALUE IS  0

The combination plot consists of all curves on the same plot.

ENTER CHOICE, 0 TO CONTINUE >>0 1.  ABSCISSA FORMAT 2.  ORDINATE
FORMAT 3.  GLOBAL FORMAT

ENTER CHOICE, 0 TO CONTINUE >>0



4.0 REVIEW OR MODIFY PLOTTING PARAMETERS:

1.  PLOTTING PACKAGE CONTROL PARAMETER (PLOT PREVIOUSLY CALCULATED
DATA) 2.  ALTITUDES TO BE PLOTTED 3.  SPECTRAL RANGE 4.  PLOT FORMAT
(ABSCISSA AND ORDINATE)

ENTER # OF ITEM TO BE CHANGED OR REVIEWED 0 TO CONTINUE >>0

Returning to main menu.
```

```
REVIEW OR MODIFY INPUT PARAMETERS

1. MODEL ATMOSPHERE
2. SOLAR ZENITH ANGLE
3. OBSERVER GEOMETRY
4. PLOTTING AND SPECTRAL PARAMETERS
5. OUTPUT CONTROL

6. UPDATE DEFAULT FILE AND EXIT

ENTER # OF ITEM TO BE CHANGED
0 TO CONTINUE HAIRM EXECUTION
```

Now one can either continue running HAIRM in the interactive mode by typing "0", or the DEFLTS file can be updated and HAIRM stopped by typing "6". This last choice is used to set up the DEFLTS file for batch execution. If we continued running HAIRM by typing "0", the following messages would be printed at your terminal:

```
CREATING INPUT FILE
RUNNING BGND2
RUNNING BGND3
RUNNING BGND4
RUNNING BGND6
RUNNING BGND7
CREATING SPECTRA FILE
RUNNING SPCTRA
ENTERING PLOTTING PACKAGE
STOP HAIRM COMPLETED
```

If batch execution is selected the following messages are printed in the job file:

```
HAIRM RUNNING IN BATCH MODE

CREATING INPUT FILE
RUNNING BGND2
RUNNING BGND3
RUNNING BGND4
RUNNING BGND6
RUNNING BGND7
CREATING SPECTRA FILE
RUNNING SPCTRA
ENTERING PLOTTING PACKAGE
STOP HAIRM COMPLETED
```

APPENDIX B

TWO TEST CASES

```
C0 FILE DEFLTS
C0 THIS FILE HOLDS THE VALUES THAT THE INPUT PARAMETERS OF
C0 HAIRM  WILL DEFAULT TO.
C0 THIS FILE IS UPDATED TO THE CURRENT VALUES OF THE PARAMETERS
C0 EACH TIME HAIRM IS RUN.
C0
C1 THE FIRST LINE CONTAINS THE INTERACTIVE/BATCH OPTION
C1 IF IT EQUALS 1, HAIRM WILL RUN INTERACTIVELY, ALLOWING
C1 THE USER TO UPDATE OPTIONS.  IF IT EQUALS 0, HAIRM WILL
C1 RUN WITHOUT STOPPING TO ALLOW THE USER TO UPDATE DEFLTS.
C1 FORMAT = I4
C1##
   0
C2 THE SECOND LINE CONTAINS THE VARIABLE IATMOS.
C2 THIS VARIABLE IS USED TO SELECT THE DESIRED MODEL ATMOSPHERE AND
C2 THE ATMOSPHERIC FILE NAME.
C2 FORMAT = I4,2X,A11
C2##  ###########
   1  ATM1976.DAT
C3 THE THIRD LINE CONTAINS THE EXO-ATMOSPHERIC TEMPERATURE AND
C3 A CONTROL PARAMETER WHICH SELECTS EITHER THE DAY(4) OR NIGHT(3)
C3 OPTION FOR THE MODEL ATMOSPHERE.  THE LAST VARIABLE CONTROL THE
C3 CONDITION OF THE CALCULATION. (NLTE ,LTE ,ETC.)
C3 FORMAT = E12.5,2X,I4,2X,I4
C3.#####E+##  ####  ####
  .10000E+04     3     3
C4 THE FOURTH LINE CONTAINS THE SOLAR ZENITH ANGLE.
C4 FORMAT = E12.5
C4.#####E+##
  .10000E-02
C5 THE FIFTH LINE CONTAINS THE INPUT FOR THE NUMBER OF
C5 ALTITUDES FOR WHICH SPECTRA WILL BE CALCULATED; MAXIMUM OF ELEVEN.
C5 FORMAT = I4
C5##
   6
C6 THE SIXTH LINE CONTAINS THE FIRST FIVE ALTITUDES (KM) FOR SPCTRA
C6 FORMAT = 5(2x,E10.4)
C6 .####E+##    .####E+##    .####E+##    .####E+##    .####E+##
   .6000E+02    .7000E+02    .8000E+02    .9000E+02    .1000E+03
C7 THE SEVENTH LINE CONTAINS THE LAST SIX ALTITUDES (KM) FOR SPCTRA
C7 FORMAT = 6(2x,E10.4)
C7 .####E+##    .####E+##    .####E+##    .####E+##    .####E+##    .####E+##
   .1500E+03    .1200E+03    .1300E+03    .1400E+03    .1500E+03    .1600E+03
C8 THE EIGHTH LINE CONTAINS A SWITCH FOR CHOOSING 1=LIMB, 2=VERTICAL,
C8 OR 3=HORIZONTAL VIEWING LEVEL FOR EACH ALTITUDE OF INTEREST.
C8 FORMAT = 5(I6,6X)
C8####      ######      ######      ######      ######
     1           1           1           1           1
```

```
C9 THE FIRST PARAMETER ENALBES PLOTTING MODE ONLY EXECUTION
C9 WHEN IT IS SET TO 0.
C9 THE SECOND PARAMETER IS THE NUMBER OF PLOTS.
C9 THE NAME OF THE FILE TO BE PLOTTED IS ALSO
C9 INCLUDED (NECESSARY WHEN IPLOT = 0).
C9 FORMAT = 2(I4),2x,A40
C9## ###  ########################################
   1   5  INPEN
C10THIS LINE CONTAINS THE FIRST FIVE ALTITUDES(KM) FOR PLOTTING.
C10FORMAT = 5(2x,E10.4)
C10.####E+##    .####E+##    .####E+##    .####E+##    .####E+##
   .6000E+02    .7000E+02    .8000E+02    .9000E+02    .1000E+03
C11THIS LINE CONTAINS THE REMAINING ALTITUDES(KM) FOR PLOTTING.
C11FORMAT = 6(2x,E10.4)
C11.####E+##    .####E+##    .####E+##    .####E+##    .####E+##    .####E+##
   .1100E+03    .1200E+03    .1300E+03    .1400E+03    .1500E+03    .1600E+03
C12 THIS LINE CONTAINS A TITLE AND NUMBER OF CHARACTERS IN THE TITLE
C12FORMAT = (A50,2X,I4)
C12################################################  ####
WAVENUMBER (1/CM)                                      17
C13 THIS LINE CONTAINS LENGTH OF ABSCISSA IN INCHES.
C13 THE WAVENUMBER MIN AND MAX.
C13 THE OFFSET BETWEEN THE ABSCISSA AXIS AND PLOT BEGINNING
C13 FORMAT = 5(E10.3,2X),I4
C13###E+##     .###E+##     .###E+##     .###E+##     .###E+##  ####
  .500E+01     .250E+03     .600E+04     .000E+00     .000E+00     0
C14 THIS LINE CONTAINS A TITLE AND NUMBER OF CHARACTERS IN FILE
C14FORMAT = (A50,2X,I4)
C14################################################  ####
RADIANCE (W/sr/cm**2/cm-1)                             26
C15 THIS LINE CONTAINS LENGTH OF ORDINATE IN INCHES.
C15 THREE PARAMETERS WHICH DETERMINE LOG OR LINEAR SCALE
C15 FORMAT= E10.3,2X,2(I4,2X)
C15###E+##  ####  ####  ####
  .500E+01     0     0     0
C16 THIS LINE CONTAINS A TITLE.
C16 ALSO A SCALING FACTOR AND A FILE CONTROL PARAMETER WHICH PLOTS
C16 ONLY THE LAST SUMMARY PLOT IF THE VARIABLE IS NON-ZERO.
C16 FORMAT = (A50,2X,E10.3,2X,I4)
C14################################################  .###E+##  ####
    TEST CASE NUMBER 1                                1.00   0
C17 THIS LINE CONTAINS THE 11 VIEWING NUMBERS: 1=LIMB,2=VERTICAL,
C17 3=HORIZONATAL FOR PLOTTING PROGRAM
C17 11(I4,2X)
C17#  ####  ####  ####  ####  ####  ####  ####  ####  ####  ####
   1     1     1     1     1     1     1     1     1     1     1
C18THIS LINE CONTAINS THE OUTPUT CONTROL PARAMTERS. A 1 MEANS THE OUTPUT
C18WILL BE SAVED TO A FILE AND A 0 MEANS THE OUTPUT WILL NOT BE SAVED.
C18 THE FILES ARE 1. OPTICAL THICKNESS FILE
C18               2. BGND2, BGND3, BGND4, BGND6, AND BGND7 OUTPUT
C18               3. ATMOSPHERIC COOLING RATES
C18               4. BGND9 OUTPUTS (RUNS FIVE TIMES)
C18               5. SPCTRA OUTPUT
C18               6. TRYPEN OUTPUT
C18 FORMAT = 6(2X,I4)
C18###  ####  ####  ####  ####  ####
     0     0     0     0     0     0
```

This is the complete INPUT file required to run the first test case. The file includes the selected atmosphere profile, 1976 Standard Atmosphere, and Band data required by the BGNDx, x = 2,3,4,6,7 , programs. The file is included here to help in HAIRM-87 installation.

```
 3
2.8815E+02 2.7517E+02 2.6220E+02 2.4922E+02 2.3624E+02 2.2327E+02
2.1665E+02 2.1665E+02 2.1665E+02 2.1665E+02 2.1665E+02 2.1857E+02
2.2056E+02 2.2254E+02 2.2452E+02 2.2651E+02 2.2849E+02 2.3374E+02
2.3927E+02 2.4480E+02 2.5033E+02 2.5586E+02 2.6139E+02 2.6692E+02
2.7065E+02 2.7065E+02 2.6903E+02 2.6354E+02 2.5804E+02 2.5255E+02
2.4706E+02 2.4157E+02 2.3607E+02 2.3058E+02 2.2509E+02 2.1959E+02
2.1426E+02 2.1035E+02 2.0643E+02 2.0252E+02 1.9861E+02 1.9470E+02
1.9078E+02 1.8687E+02 1.8687E+02 1.8687E+02 1.8698E+02 1.8774E+02
1.8931E+02 1.9172E+02 1.9508E+02 1.9953E+02 2.0531E+02 2.1289E+02
2.2329E+02 2.4000E+02 2.6400E+02 2.8800E+02 3.1200E+02 3.3600E+02
3.6000E+02 3.8355E+02 4.0622E+02 4.2804E+02 4.4904E+02 4.6927E+02
4.8838E+02 5.0748E+02 5.2519E+02 5.4290E+02 5.5932E+02 5.7573E+02
5.9095E+02 6.0617E+02 6.2028E+02 6.3439E+02 6.9629E+02 7.4757E+02
7.9007E+02 8.2531E+02 8.5456E+02 8.7679E+02 8.9901E+02 9.0739E+02
9.1578E+02 9.3338E+02 9.5099E+02 9.5724E+02 9.6350E+02 9.6976E+02
9.7601E+02 9.7882E+02 9.8163E+02 9.8444E+02 9.8725E+02 9.9006E+02
9.9121E+02 9.9237E+02 9.9352E+02 9.9468E+02 9.9583E+02 9.9617E+02
9.9651E+02 9.9685E+02 9.9719E+02 9.9753E+02 9.9788E+02 9.9822E+02
9.9856E+02 9.9890E+02 9.9924E+02 9.9930E+02 9.9936E+02 9.9942E+02
9.9948E+02 9.9955E+02 9.9961E+02 9.9967E+02 9.9973E+02 9.9979E+02
9.9985E+02 9.9986E+02 9.9987E+02 9.9989E+02 9.9990E+02 9.9991E+02
9.9992E+02 9.9993E+02 9.9995E+02 9.9996E+02 9.9997E+02
1.9888E+19 1.6341E+19 1.3302E+19 1.0717E+19 8.5372E+18 6.7150E+18
5.0778E+18 3.7093E+18 2.7101E+18 1.9804E+18 1.4475E+18 1.0504E+18
7.6429E+17 5.5783E+17 4.0835E+17 2.9981E+17 2.2075E+17 1.6106E+17
1.1823E+17 8.7424E+16 6.5093E+16 4.8788E+16 3.6799E+16 2.7925E+16
2.1438E+16 1.6720E+16 1.3111E+16 1.0399E+16 8.2094E+15 6.4489E+15
5.0401E+15 3.9179E+15 3.0285E+15 2.3272E+15 1.7774E+15 1.3487E+15
1.0158E+15 7.5547E+14 5.5885E+14 4.1110E+14 3.0067E+14 2.1859E+14
1.5792E+14 1.1335E+14 7.9416E+13 5.5653E+13 3.8990E+13 2.7250E+13
1.9010E+13 1.3255E+13 9.2490E+12 6.4652E+12 4.5314E+12 3.1853E+12
2.2430E+12 1.5690E+12 1.1070E+12 8.0527E+11 6.0096E+11 4.5838E+11
3.5627E+11 2.8177E+11 2.2647E+11 1.8454E+11 1.5219E+11 1.2683E+11
1.0674E+11 9.0442E+10 7.7300E+10 6.6417E+10 5.7475E+10 4.9948E+10
4.3665E+10 3.8305E+10 3.3772E+10 2.9862E+10 1.6954E+10 1.0227E+10
6.4440E+09 4.1942E+09 2.7983E+09 1.9071E+09 1.3137E+09 9.2566E+08
6.5502E+08 4.6161E+08 3.2777E+08 2.3676E+08 1.7154E+08 1.2467E+08
9.0872E+07 6.6632E+07 4.8946E+07 3.6019E+07 2.6553E+07 1.9609E+07
1.4528E+07 1.0776E+07 8.0030E+06 5.9509E+06 4.4304E+06 3.3046E+06
2.4673E+06 1.8439E+06 1.3794E+06 1.0328E+06 7.7408E+05 5.8070E+05
4.3604E+05 3.2772E+05 2.4654E+05 1.8568E+05 1.3997E+05 1.0559E+05
7.9729E+04 6.0250E+04 4.5567E+04 3.4491E+04 2.6129E+04 1.9810E+04
1.5031E+04 1.1415E+04 8.6760E+03 6.5992E+03 5.0235E+03 3.8270E+03
2.9178E+03 2.2263E+03 1.7000E+03 1.2991E+03 9.9349E+02
5.3354E+18 4.3838E+18 3.5685E+18 2.8751E+18 2.2903E+18 1.8014E+18
1.3622E+18 9.9508E+17 7.2703E+17 5.3130E+17 3.8833E+17 2.8178E+17
2.0504E+17 1.4965E+17 1.0955E+17 8.0429E+16 5.9220E+16 4.3207E+16
3.1718E+16 2.3453E+16 1.7463E+16 1.3088E+16 9.8720E+15 7.4913E+15
5.7511E+15 4.4854E+15 3.5172E+15 2.7897E+15 2.2023E+15 1.7301E+15
```

1.3521E+15 1.0510E+15 8.1245E+14 6.2433E+14 4.7682E+14 3.6181E+14
2.7251E+14 2.0267E+14 1.4992E+14 1.1029E+14 8.0661E+13 5.8641E+13
4.2366E+13 3.0409E+13 2.1305E+13 1.4930E+13 1.0460E+13 7.3104E+12
5.0997E+12 3.5560E+12 2.4812E+12 1.7344E+12 1.2156E+12 8.5452E+11
6.0174E+11 4.2093E+11 2.8647E+11 2.0163E+11 1.4599E+11 1.0828E+11
8.1997E+10 6.3292E+10 4.9716E+10 3.9644E+10 3.2027E+10 2.6169E+10
2.1614E+10 1.7985E+10 1.5105E+10 1.2762E+10 1.0864E+10 9.2931E+09
7.9998E+09 6.9133E+09 6.0066E+09 5.2357E+09 2.7792E+09 1.5760E+09
9.3719E+08 5.7740E+08 3.6549E+08 2.3673E+08 1.5519E+08 1.0418E+08
7.0274E+07 4.7246E+07 3.2037E+07 2.2115E+07 1.5320E+07 1.0649E+07
7.4278E+06 5.2134E+06 3.6667E+06 2.5841E+06 1.8249E+06 1.2913E+06
9.1685E+05 6.5190E+05 4.6416E+05 3.3095E+05 2.3630E+05 1.6906E+05
1.2109E+05 8.6830E+04 6.2329E+04 4.4790E+04 3.2221E+04 2.3204E+04
1.6729E+04 1.2073E+04 8.7223E+03 6.3097E+03 4.5688E+03 3.3114E+03
2.4023E+03 1.7445E+03 1.2680E+03 9.2249E+02 6.7177E+02 4.8964E+02
3.5723E+02 2.6087E+02 1.9068E+02 1.3950E+02 1.0215E+02 7.4865E+01
5.4918E+01 4.0321E+01 2.9630E+01 2.1792E+01 1.6042E+01
1.0000E-06 2.5119E-06 6.3096E-06 1.5849E-05 3.9811E-05 1.0000E-04
2.5119E-04 6.3096E-04 1.5849E-03 3.9811E-03 1.0000E-02 2.5119E-02
6.3096E-02 1.5849E-01 3.9811E-01 1.0000E+00 2.5119E+00 6.3096E+00
1.5849E+01 3.9811E+01 1.0000E+02 2.5119E+02 6.3096E+02 1.5849E+03
3.9811E+03 1.0000E+04 2.5119E+04 6.3096E+04 1.5849E+05 3.9811E+05
1.0000E+06 2.5119E+06 6.3096E+06 1.5849E+07 3.9811E+07 1.0000E+08
2.5119E+08 6.3096E+08 1.5849E+09 3.9811E+09 1.0000E+10 2.0488E+10
4.1976E+10 8.6000E+10 1.5100E+11 2.4400E+11 3.4300E+11 4.1600E+11
4.4700E+11 4.4800E+11 4.3000E+11 4.0100E+11 3.6200E+11 3.1900E+11
2.7500E+11 2.3000E+11 1.8900E+11 1.5600E+11 1.3000E+11 1.1000E+11
9.2800E+10 7.9883E+10 6.8765E+10 5.9812E+10 5.2567E+10 4.6200E+10
4.1344E+10 3.6998E+10 3.3303E+10 3.0153E+10 2.7300E+10 2.4951E+10
2.2803E+10 2.0934E+10 1.9303E+10 1.7800E+10 1.2400E+10 9.0000E+09
6.7500E+09 5.1800E+09 4.0500E+09 3.2353E+09 2.5845E+09 2.0869E+09
1.7032E+09 1.3900E+09 1.1471E+09 9.4668E+08 7.8444E+08 6.5265E+08
5.4300E+08 4.5528E+08 3.8173E+08 3.2006E+08 2.6835E+08 2.2500E+08
1.8968E+08 1.5990E+08 1.3480E+08 1.1364E+08 9.5800E+07 8.1080E+07
6.8621E+07 5.8077E+07 4.9153E+07 4.1600E+07 3.5338E+07 3.0018E+07
2.5499E+07 2.1661E+07 1.8400E+07 1.5677E+07 1.3358E+07 1.1381E+07
9.6971E+06 8.2622E+06 7.0397E+06 5.9980E+06 5.1105E+06 4.3543E+06
3.7100E+06 3.1759E+06 2.7187E+06 2.3273E+06 1.9923E+06 1.7055E+06
1.4600E+06 1.2498E+06 1.0699E+06 9.1584E+05 7.8400E+05
2.3789E+17 1.9546E+17 1.5911E+17 1.2819E+17 1.0212E+17 8.0321E+16
6.0738E+16 4.4368E+16 3.2417E+16 2.3689E+16 1.7315E+16 1.2564E+16
9.1421E+15 6.6724E+15 4.8845E+15 3.5861E+15 2.6405E+15 1.9265E+15
1.4142E+15 1.0457E+15 7.7861E+14 5.8357E+14 4.4017E+14 3.3402E+14
2.5643E+14 1.9999E+14 1.5682E+14 1.2439E+14 9.8196E+13 7.7139E+13
6.0287E+13 4.6863E+13 3.6225E+13 2.7837E+13 2.1260E+13 1.6132E+13
1.2151E+13 9.0365E+12 6.6846E+12 4.9174E+12 3.5965E+12 2.6146E+12
1.8890E+12 1.3558E+12 9.4994E+11 6.6570E+11 4.6638E+11 3.2595E+11
2.2738E+11 1.5855E+11 1.1063E+11 7.7334E+10 5.4202E+10 3.8101E+10
2.6830E+10 1.8768E+10 1.1886E+10 7.8350E+09 5.3408E+09 3.7462E+09
2.6932E+09 1.9803E+09 1.4860E+09 1.1348E+09 8.7986E+08 6.9127E+08
5.4987E+08 4.4130E+08 3.5797E+08 2.9242E+08 2.4096E+08 1.9970E+08
1.6679E+08 1.3981E+08 1.1798E+08 9.9943E+07 4.6388E+07 2.3255E+07
1.2322E+07 6.8043E+06 3.8779E+06 2.2693E+06 1.3479E+06 8.2143E+05
5.0361E+05 3.0824E+05 1.9067E+05 1.2024E+05 7.6155E+04 4.8442E+04
3.0915E+04 1.9905E+04 1.2837E+04 8.2995E+03 5.3796E+03 3.4958E+03

2.2803E+03 1.4900E+03 9.7536E+02 6.3957E+02 4.2011E+02 2.7661E+02
1.8238E+02 1.2041E+02 7.9610E+01 5.2704E+01 3.4939E+01 2.3193E+01
1.5416E+01 1.0261E+01 6.8385E+00 4.5647E+00 3.0506E+00 2.0411E+00
1.3673E+00 9.1704E-01 6.1577E-01 4.1396E-01 2.7862E-01 1.8774E-01
1.2665E-01 8.5543E-02 5.7843E-02 3.9156E-02 2.6536E-02 1.8004E-02
1.2228E-02 8.3146E-03 5.6598E-03 3.8569E-03 2.6312E-03
7.9976E+15 6.5712E+15 5.3491E+15 4.3098E+15 3.4331E+15 2.7003E+15
2.0420E+15 1.4916E+15 1.0898E+15 7.9640E+14 5.8210E+14 4.2239E+14
3.0735E+14 2.2432E+14 1.6421E+14 1.2056E+14 8.8770E+13 6.4766E+13
4.7545E+13 3.5156E+13 2.6176E+13 1.9619E+13 1.4798E+13 1.1229E+13
8.6208E+12 6.7235E+12 5.2722E+12 4.1818E+12 3.3012E+12 2.5933E+12
2.0268E+12 1.5755E+12 1.2178E+12 9.3586E+11 7.1474E+11 5.4235E+11
4.0849E+11 3.0380E+11 2.2473E+11 1.6532E+11 1.2091E+11 8.7901E+10
6.3505E+10 4.5582E+10 3.1936E+10 2.2380E+10 1.5679E+10 1.0958E+10
7.6444E+09 5.3303E+09 3.7193E+09 2.5999E+09 1.8222E+09 1.2809E+09
9.0199E+08 6.3096E+08 3.8519E+08 2.4553E+08 1.6228E+08 1.1063E+08
7.7452E+07 5.5552E+07 4.0724E+07 3.0420E+07 2.3095E+07 1.7785E+07
1.3878E+07 1.0934E+07 8.7128E+06 6.9961E+06 5.6699E+06 4.6236E+06
3.7995E+06 3.1382E+06 2.6089E+06 2.1781E+06 9.4394E+05 4.4431E+05
2.2195E+05 1.1589E+05 6.2601E+04 3.4781E+04 1.9643E+04 1.1394E+04
6.6526E+03 3.8811E+03 2.2906E+03 1.3793E+03 8.3449E+02 5.0729E+02
3.0983E+02 1.9060E+02 1.1759E+02 7.2752E+01 4.5136E+01 2.8081E+01
1.7540E+01 1.0977E+01 6.8835E+00 4.3247E+00 2.7222E+00 1.7179E+00
1.0857E+00 6.8722E-01 4.3564E-01 2.7657E-01 1.7584E-01 1.1197E-01
7.1401E-02 4.5598E-02 2.9162E-02 1.8682E-02 1.1984E-02 7.6974E-03
4.9506E-03 3.1881E-03 2.0558E-03 1.3274E-03 8.5813E-04 5.5549E-04
3.6004E-04 2.3367E-04 1.5184E-04 9.8787E-05 6.4351E-05 4.1971E-05
2.7408E-05 1.7919E-05 1.1730E-05 7.6877E-06 5.0445E-06
6.3675E+17 2.6160E+17 2.8392E+16 8.0065E+15 2.7334E+14 9.3162E+13
4.3353E+13 1.5835E+13 8.6770E+12 6.7637E+12 5.4070E+12 4.1476E+12
3.1812E+12 2.5004E+12 1.9175E+12 1.5038E+12 1.1544E+12 8.9379E+11
6.8137E+11 5.2249E+11 4.0292E+11 3.0719E+11 2.3170E+11 1.7881E+11
1.3727E+11 1.0706E+11 8.3952E+10 6.6589E+10 5.1692E+10 4.0607E+10
3.1197E+10 2.3833E+10 1.8099E+10 1.3412E+10 1.0053E+10 7.3407E+09
5.3121E+09 3.7088E+09 2.5646E+09 1.7549E+09 1.1552E+09 7.2318E+08
4.3819E+08 2.6614E+08 1.5256E+08 8.9093E+07 4.7853E+07 2.6174E+07
1.3187E+07 5.6585E+06 2.4677E+06 1.3800E+06 8.7048E+05 5.6092E+05
3.7104E+05 2.5118E+05 1.9400E+05 1.5326E+05 1.2339E+05 1.0096E+05
8.3768E+04 7.0425E+04 5.9953E+04 5.1585E+04 4.4798E+04 3.9220E+04
3.4608E+04 3.0688E+04 2.7403E+04 2.4562E+04 2.2144E+04 2.0025E+04
1.8196E+04 1.6575E+04 1.5161E+04 1.3895E+04 9.3398E+03 6.5788E+03
4.7925E+03 3.5798E+03 2.7255E+03 2.1104E+03 1.6458E+03 1.3097E+03
1.0451E+03 8.2883E+02 6.6058E+02 5.3465E+02 4.3358E+02 3.5230E+02
2.8683E+02 2.3470E+02 1.9227E+02 1.5769E+02 1.2949E+02 1.0644E+02
8.7730E+01 7.2368E+01 5.9740E+01 4.9358E+01 4.0810E+01 3.3793E+01
2.8000E+01 2.3215E+01 1.9260E+01 1.5988E+01 1.3280E+01 1.1037E+01
9.1788E+00 7.6380E+00 6.3595E+00 5.2995E+00 4.4188E+00 3.6863E+00
3.0768E+00 2.5695E+00 2.1470E+00 1.7949E+00 1.5014E+00 1.2565E+00
1.0521E+00 8.8143E-01 7.3883E-01 6.1963E-01 5.1990E-01 4.3645E-01
3.6658E-01 3.0805E-01 2.5900E-01 2.1786E-01 1.8335E-01
2.5000E+10 2.1047E+10 1.7720E+10 1.4918E+10 1.2559E+10 1.0574E+10
8.9019E+09 7.4945E+09 6.3096E+09 5.3120E+09 4.4721E+09 3.7651E+09
3.1698E+09 2.6686E+09 2.2467E+09 1.8915E+09 1.5924E+09 1.3407E+09
1.1287E+09 9.5024E+08 8.0000E+08 6.4299E+08 5.1680E+08 4.1537E+08
3.3385E+08 2.6833E+08 2.1567E+08 1.7334E+08 1.3932E+08 1.1198E+08

9.0000E-07 7.2000E+07 5.8000E+07 4.6000E+07 3.7000E+07 2.9000E+07
2.3000E+07 1.8000E+07 1.4000E+07 1.1500E+07 9.6000E+06 8.7000E+06
8.2000E+06 8.7000E+06 1.0500E+07 1.4000E+07 1.8000E+07 2.3000E+07
3.0000E+07 3.6000E+07 4.0000E+07 4.2000E+07 4.4000E+07 4.5000E+07
4.4000E+07 4.2000E+07 3.9000E+07 3.5000E+07 3.1000E+07 2.7000E+07
2.3000E+07 2.0381E+07 1.8059E+07 1.5856E+07 1.3794E+07 1.2000E+07
1.0447E+07 9.0943E+06 7.9170E+06 6.8922E+06 6.0000E+06 5.2058E+06
4.5167E+06 3.9188E+06 3.4001E+06 2.9500E+06 1.6000E+06 9.5917E+05
5.7500E+05 3.6759E+05 2.3500E+05 1.6011E+05 1.0909E+05 7.4322E+04
5.0637E+04 3.4500E+04 2.4436E+04 1.7308E+04 1.2259E+04 8.6829E+03
6.1500E+03 4.4464E+03 3.2147E+03 2.3242E+03 1.6804E+03 1.2149E+03
8.7837E+02 6.3505E+02 4.5914E+02 3.3195E+02 2.4000E+02 1.7633E+02
1.2955E+02 9.5184E+01 6.9933E+01 5.1381E+01 3.7750E+01 2.7736E+01
2.0378E+01 1.4972E+01 1.1000E+01 8.1450E+00 6.0311E+00 4.4657E+00
3.3067E+00 2.4485E+00 1.8130E+00 1.3424E+00 9.9402E-01 7.3603E-01
5.4500E-01 4.0782E-01 3.0517E-01 2.2836E-01 1.7088E-01 1.2787E-01
9.5682E-02 7.1598E-02 5.3577E-02 4.0091E-02 3.0000E-02
2.5470E+14 2.0927E+14 1.7035E+14 1.3725E+14 1.0933E+14 8.5997E+13
6.5030E+13 4.7504E+13 3.4707E+13 2.5363E+13 1.8538E+13 1.3452E+13
9.7881E+12 7.1439E+12 5.2296E+12 3.8395E+12 2.8271E+12 2.0626E+12
1.5142E+12 1.1196E+12 8.3363E+11 6.2481E+11 4.7127E+11 3.5762E+11
2.7455E+11 2.1412E+11 1.6790E+11 1.3318E+11 1.0514E+11 8.2590E+10
6.4547E+10 5.0175E+10 3.8785E+10 2.9804E+10 2.2762E+10 1.7272E+10
1.3009E+10 9.6751E+09 7.1570E+09 5.2648E+09 3.8506E+09 2.7994E+09
2.0225E+09 1.4517E+09 1.0171E+09 7.1274E+08 4.9934E+08 3.4899E+08
2.4345E+08 1.6976E+08 1.1845E+08 8.2798E+07 5.8032E+07 4.0793E+07
2.8726E+07 2.0094E+07 1.3924E+07 9.9633E+06 7.3239E+06 5.5086E+06
4.2261E+06 3.3020E+06 2.6236E+06 2.1149E+06 1.7263E+06 1.4245E+06
1.1876E+06 9.9721E+05 8.4490E+05 7.1985E+05 6.1786E+05 5.3271E+05
4.6212E+05 4.0237E+05 3.5216E+05 3.0917E+05 1.6973E+05 9.9267E+04
6.0764E+04 3.8478E+04 2.5006E+04 1.6614E+04 1.1164E+04 7.6784E+03
5.3049E-03 3.6515E+03 2.5337E+03 1.7892E+03 1.2676E+03 9.0093E+02
6.4239E+02 4.6084E+02 3.3124E+02 2.3855E+02 1.7212E+02 1.2442E+02
9.0240E+01 6.5534E+01 4.7655E+01 3.4700E+01 2.5299E+01 1.8482E+01
1.3515E+01 9.8937E+00 7.2500E+00 5.3181E+00 3.9049E+00 2.8702E+00
2.1118E+00 1.5553E+00 1.1466E+00 8.4633E-01 6.2526E-01 4.6235E-01
3.4220E-01 2.5349E-01 1.8795E-01 1.3947E-01 1.0359E-01 7.7008E-02
5.7296E-02 4.2669E-02 3.1803E-02 2.3724E-02 1.7712E-02 1.3235E-02
9.8976E-03 7.4080E-03 5.5492E-03 4.1603E-03 3.1215E-03
6.8000E+11 6.8000E+11 5.8000E+11 5.7000E+11 6.5000E+11 1.1300E+12
2.0200E+12 2.3500E+12 2.9500E+12 4.0400E+12 4.7700E+12 4.8600E+12
4.5100E+12 4.0300E+12 3.2300E+12 2.5200E+12 2.0300E+12 1.5800E+12
1.2200E+12 8.7300E+11 6.0700E+11 3.9800E+11 2.7400E+11 1.6900E+11
1.0300E+11 6.6400E+10 3.8400E+10 2.5500E+10 1.6100E+10 1.1200E+10
7.3300E+09 4.8100E+09 3.1700E+09 1.8000E+09 8.7000E+08 3.8000E+08
1.6000E+08 8.0000E+07 1.0000E+08 1.5000E+08 2.1000E+08 2.5000E+08
2.8000E+08 2.6000E+08 2.2000E+08 1.8000E+08 1.3000E+08 9.2000E+07
6.2000E+07 3.6000E+07 2.6000E+07 1.8174E+07 1.2738E+07 8.9543E+06
6.2954E+06 4.1108E+06 2.5972E+06 1.6019E+06 1.0272E+06 6.8093E+05
4.6116E+05 3.2511E+05 2.3293E+05 1.7026E+05 1.2662E+05 9.5609E+04
7.3214E+04 5.6645E+04 4.4356E+04 3.5020E+04 2.7921E+04 2.2410E+04
1.8134E+04 1.4754E+04 1.2087E+04 9.9479E+03 4.0306E+03 1.7834E+03
8.4076E+02 4.1555E+02 2.1295E+02 1.1244E+02 6.0436E+01 3.3394E+01
1.8586E+01 1.0344E+01 5.8299E+00 3.3547E+00 1.9405E+00 1.1283E+00
6.5933E-01 3.8826E-01 2.2934E-01 1.3588E-01 8.0754E-02 4.8137E-02

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 2.8816E-02 1.7286E-02 1.0392E-02 6.2601E-03 3.7790E-03 2.2874E-03
 1.3868E-03 8.4220E-04 5.1229E-04 3.1213E-04 1.9048E-04 1.1643E-04
 7.1281E-05 4.3710E-05 2.6846E-05 1.6518E-05 1.0178E-05 6.2804E-06
 3.8809E-06 2.4016E-06 1.4882E-06 9.2356E-07 5.7394E-07 3.5717E-07
 2.2258E-07 1.3890E-07 8.6803E-08 5.4317E-08 3.4035E-08 2.1355E-08
 1.3417E-08 8.4406E-09 5.3171E-09 3.3539E-09 2.1183E-09
 4.8393E+12 3.7669E+12 2.7256E+12 1.9215E+12 1.3120E+12 8.5997E+11
 5.2024E+11 2.8502E+11 1.3883E+11 5.0726E+10 1.8538E+10 1.3452E+10
 9.7881E+09 7.1439E+09 5.2296E+09 3.8395E+09 2.8271E+09 2.0626E+09
 1.5142E+09 1.1196E+09 8.3363E+08 6.5605E+08 5.4196E+08 4.6491E+08
 4.2555E+08 4.2824E+08 4.6173E+08 5.3272E+08 6.3084E+08 7.4331E+08
 9.0366E+08 1.0035E+09 1.0860E+09 1.1922E+09 1.2291E+09 1.2090E+09
 1.2489E+09 1.2578E+09 1.2167E+09 1.1583E+09 1.1552E+09 1.1757E+09
 1.1124E+09 1.1323E+09 1.0680E+09 1.0691E+09 1.0486E+09 9.7717E+08
 8.7642E+08 7.8090E+08 7.1070E+08 5.7959E+08 4.6426E+08 3.6714E+08
 2.7577E+08 2.0094E+08 1.4178E+08 1.0313E+08 7.6969E+07 5.8709E+07
 4.5631E+07 3.6091E+07 2.9007E+07 2.3638E+07 1.9494E+07 1.6245E+07
 1.3673E+07 1.1585E+07 9.9018E+06 8.5079E+06 7.3624E+06 6.3984E+06
 5.5935E+06 4.9070E+06 4.3264E+06 3.8255E+06 2.1721E+06 1.3103E+06
 8.2563E+05 5.3739E+05 3.5856E+05 2.4437E+05 1.6834E+05 1.1862E+05
 8.3942E+04 5.9158E+04 4.2006E+04 3.0343E+04 2.1986E+04 1.5979E+04
 1.1648E+04 8.5409E+03 6.2741E+03 4.6172E+03 3.4039E+03 2.5138E+03
 1.8624E+03 1.3815E+03 1.0260E+03 7.6298E+02 5.6804E+02 4.2372E+02
 3.1637E-02 2.3644E+02 1.7688E+02 1.3244E+02 9.9266E+01 7.4470E+01
 5.5920E+01 4.2030E+01 3.1619E+01 2.3815E+01 1.7952E+01 1.3544E+01
 1.0227E+01 7.7283E+00 5.8451E+00 4.4245E+00 3.3518E+00 2.5413E+00
 1.9284E+00 1.4645E+00 1.1131E+00 8.4668E-01 6.4453E-01 4.9103E-01
 3.7438E-01 2.8566E-01 2.1813E-01 1.6670E-01 1.2749E-01
7
METHANE - CH4              1   120.
CARBON DIOXIDE - CO2       2   700.
WATER VAPOR - H2O          3   700.
NITRIC OXIDE - NO          4   700.
NITROUS OXIDE - N2O        5   150.
OZONE - O3  PRE-DAWN       6   700.
CARBON MONOXIDE - CO       7   700.  MOL NO DEN - ICAO ST ATM 8 700.
TEMP - ICAO STD. ATMOS.    1   700.  METHANE 4 4 16.00 .1000E-14 .2000E-14
    11      0        .0000      .34000                                        1  1
    31      0    1306.2000      .35000                                        1  2
    31      0    3018.3999      .35000                                        1  3
    21      2    1526.0000      .35000                                        1  4
   201     11  1.8500E+02  3.1500E+15  1.6000E+16  0.0000E+00  0.0000E+00    1  1
   301     11  3.2000E+02  3.1000E+16  4.0000E+13  0.0000E+00  0.0000E+00    1  2
   401     11  2.4000E+00  4.9000E+15  3.5000E+15  0.0000E+00  0.0000E+00    1  3
   302     11  1.0000E-02  6.8000E+15  1.8000E+15  0.0000E+00  0.0000E+00    1  4
CARBON D                      16   29    44.00        .0000E+00       .0000E+00
    12      0        .0000      .39021                                        2  1
    21      0     667.3790      .39094                                        2  2
    12      0    1285.4087      .39048                                        2  3
    22      0    1335.1290      .39166                                        2  4
    11      0    1388.1847      .39122                                        2  5
    21      0    1932.4720      .39236                                        2  6
    22      0    2003.2440      .39020                                        2  7
    21      0    2076.8550      .39020                                        2  8
    11      0    2349.1433      .38750                                        2  9
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21	0	3004.0120	.38705				2	10
12	0	3612.8420	.39020				2	11
21	0	3659.8721	.39020				2	12
11	0	3714.7830	.38750				2	13
12	0	4853.6289	.39020				2	14
11	0	4977.8389	.39020				2	15
11	0	5099.6631	.38750				2	16
201	12	8.2580E-18	4.6000E+14	0.0000E+00	0.0000E+00	0.0000E+00	2	1
302	12	1.4360E-19	3.7000E+14	0.0000E+00	0.0000E+00	0.0000E+00	2	2
402	12	6.4880E-19	4.6000E+14	0.0000E+00	0.0000E+00	0.0000E+00	2	3
502	12	2.2200E-20	4.2000E+14	0.0000E+00	0.0000E+00	0.0000E+00	2	4
601	12	5.2080E-21	3.3500E+14	0.0000E+00	0.0000E+00	0.0000E+00	2	5
603	12	3.8240E-20	4.6000E+14	0.0000E+00	0.0000E+00	0.0000E+00	2	6
604	12	1.8530E-19	5.8000E+14	0.0000E+00	0.0000E+00	0.0000E+00	2	7
605	11	4.9100E-22	1.3100E+15	0.0000E+00	0.0000E+00	0.0000E+00	2	8
704	11	9.5980E-17	1.6000E+16	0.0000E+00	0.0000E+00	0.0000E+00	2	9
801	11	6.3240E-22	1.7800E+15	0.0000E+00	0.0000E+00	0.0000E+00	2	10
803	11	1.0350E-18	4.9500E+16	0.0000E+00	0.0000E+00	0.0000E+00	2	11
804	11	1.5000E-18	5.3500E+16	0.0000E+00	0.0000E+00	0.0000E+00	2	12
805	11	1.9340E-19	1.6000E+16	0.0000E+00	0.0000E+00	0.0000E+00	2	13
901	11	1.0590E-22	1.7500E+16	0.0000E+00	0.0000E+00	0.0000E+00	2	14
903	11	1.2720E-22	1.3900E+16	0.0000E+00	0.0000E+00	0.0000E+00	2	15
905	11	1.1830E-19	1.6000E+16	0.0000E+00	0.0000E+00	0.0000E+00	2	16
1002	11	1.0350E-18	4.9500E+16	0.0000E+00	0.0000E+00	0.0000E+00	2	17
1101	11	1.5000E-18	5.3500E+16	0.0000E+00	0.0000E+00	0.0000E+00	2	18
1103	11	1.9340E-19	1.6000E+16	0.0000E+00	0.0000E+00	0.0000E+00	2	19
1204	11	1.0590E-22	1.7500E+16	0.0000E+00	0.0000E+00	0.0000E+00	2	20
1301	11	1.2720E-22	1.3900E+16	0.0000E+00	0.0000E+00	0.0000E+00	2	21
1305	11	1.1830E-19	1.6000E+16	0.0000E+00	0.0000E+00	0.0000E+00	2	22
1401	11	1.1830E-19	1.6000E+16	0.0000E+00	0.0000E+00	0.0000E+00	2	23
1403	11	1.0350E-18	4.9500E+16	0.0000E+00	0.0000E+00	0.0000E+00	2	24
1501	11	1.5000E-18	5.3500E+16	0.0000E+00	0.0000E+00	0.0000E+00	2	25
1503	11	1.9340E-19	1.6000E+16	0.0000E+00	0.0000E+00	0.0000E+00	2	26
1505	11	1.0590E-22	1.7500E+16	0.0000E+00	0.0000E+00	0.0000E+00	2	27
1601	11	1.2720E-22	1.3900E+16	0.0000E+00	0.0000E+00	0.0000E+00	2	28
1605	11	1.1830E-19	1.6000E+16	0.0000E+00	0.0000E+00	0.0000E+00	2	29
WATER VA			8 14	18.00	.5000E-10	.2000E-14		
11	0	.0000	.03000				3	1
11	0	1594.7500	.03000				3	2
11	0	3151.6331	.03000				3	3
11	0	3657.1001	.03000				3	4
11	0	3755.8999	.03000				3	5
11	0	4666.7959	.03000				3	6
11	0	5234.9951	.03000				3	7
11	0	5331.2720	.03000				3	8
201	11	1.0380E-17	5.6000E+15	0.0000E+00	0.0000E+00	0.0000E+00	3	1
301	11	6.5800E-20	3.5000E+16	0.0000E+00	0.0000E+00	0.0000E+00	3	2
401	11	3.6200E-19	5.1000E+16	0.0000E+00	0.0000E+00	0.0000E+00	3	3
501	11	7.9940E-18	5.4000E+16	0.0000E+00	0.0000E+00	0.0000E+00	3	4
302	11	8.6100E-21	5.2000E+15	0.0000E+00	0.0000E+00	0.0000E+00	3	5
402	11	8.9000E-23	1.2000E+16	0.0000E+00	0.0000E+00	0.0000E+00	3	6
502	11	4.9000E-22	1.5000E+16	0.0000E+00	0.0000E+00	0.0000E+00	3	7
602	11	7.3030E-23	3.3000E+16	0.0000E+00	0.0000E+00	0.0000E+00	3	8
702	11	1.9460E-22	5.0000E+16	0.0000E+00	0.0000E+00	0.0000E+00	3	9
802	11	2.9230E-21	5.4000E+16	0.0000E+00	0.0000E+00	0.0000E+00	3	10

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   603    11  5.1350E-24  4.9000E+15  0.0000E+00  0.0000E+00  0.0000E+00  3 11
   601    11  2.0000E-22  9.3000E+16  0.0000E+00  0.0000E+00  0.0000E+00  3 12
   701    11  1.8300E-20  1.2000E+17  0.0000E+00  0.0000E+00  0.0000E+00  3 13
   801    11  9.0600E-19  1.2500E+17  0.0000E+00  0.0000E+00  0.0000E+00  3 14
NITRIC O                      3   3    30.00       .4000E-14       .2000E-14
    11     0       .0000     1.69610                                      4  1
    11     1    1878.0000    1.67920                                      4  2
    11     0    3727.0000    1.66050                                      4  3
   201    11  5.0000E-18  8.7000E+15  0.0000E+00  0.0000E+00  0.0000E+00  4  1
   301    11  8.5000E-20  5.4000E+16  0.0000E+00  0.0000E+00  0.0000E+00  4  2
   302    11  1.2700E-21  8.4000E+15  0.0000E+00  0.0000E+00  0.0000E+00  4  3
NITROUS                       7   3    44.00       .1000E-14       .2500E-12
    11     0       .0000     .41901                                       5  1
    21     0     588.8000    .40000                                       5  2
    31     0    1173.0000    .40000                                       5  3
    41     0    1758.8000    .40000                                       5  4
    51     0    2338.5000    .40000                                       5  5
    11     1    2223.5000    .40000                                       5  6
    11     0    1285.0000    .40000                                       5  7
   201    12  3.3000E+01  3.4000E+14  2.5000E+16  0.0000E+00  0.0000E+00  5  1
   701    11  2.6000E+02  3.0000E+15  1.8000E+16  0.0000E+00  0.0000E+00  5  2
   601    11  1.8560E+03  1.6000E+16  1.3000E+01  4.0000E-05  0.0000E+00  5  3
OZONE PR                     18  30    48.00       .2400E-13       .1000E-13
    11     0       .0000     .00030                                       6  1
    11     0     700.9320    .00030                                       6  2
    11     0    1042.0840    .00030                                       6  3
    11     0    1103.1410    .00030                                       6  4
    11     0    1399.2750    .00030                                       6  5
    11     0    1726.5280    .00030                                       6  6
    11     0    1796.2610    .00030                                       6  7
    11     0    2057.8921    .00030                                       6  8
    11     0    2110.7910    .00030                                       6  9
    11     0    2201.1570    .00030                                       6 10
    11     0    2785.2410    .00030                                       6 11
    11     0    3041.2000    .00030                                       6 12
    11     0    3988.0000    .00030                                       6 13
    11     0    4910.0000    .00030                                       6 14
    11     0    5803.0000    .00030                                       6 15
    11     0    6665.0000    .00030                                       6 16
    11     0    7497.0000    .00030                                       6 17
    11     0    8299.0000    .00030                                       6 18
   201    11  6.2830E-19  5.3000E+14  0.0000E+00  0.0000E+00  0.0000E+00  6  1
   301    11  1.3940E-17  1.6800E+15  0.0000E+00  0.0000E+00  0.0000E+00  6  2
   401    11  6.7110E-19  1.9700E+15  0.0000E+00  0.0000E+00  0.0000E+00  6  3
   502    11  4.1640E-20  5.2000E+14  0.0000E+00  0.0000E+00  0.0000E+00  6  4
   601    11  5.3730E-20  7.5000E+15  0.0000E+00  0.0000E+00  0.0000E+00  6  5
   602    11  4.5030E-19  1.6000E+15  0.0000E+00  0.0000E+00  0.0000E+00  6  6
   701    11  2.2660E-20  7.7000E+15  0.0000E+00  0.0000E+00  0.0000E+00  6  7
   702    11  1.1040E-20  2.2500E+15  0.0000E+00  0.0000E+00  0.0000E+00  6  8
   801    11  1.1100E-19  1.1200E+16  0.0000E+00  0.0000E+00  0.0000E+00  6  9
   803    11  1.7430E-19  1.5500E+15  0.0000E+00  0.0000E+00  0.0000E+00  6 10
   901    11  1.1340E-18  1.2000E+16  0.0000E+00  0.0000E+00  0.0000E+00  6 11
   903    11  3.3220E-21  1.8000E+15  0.0000E+00  0.0000E+00  0.0000E+00  6 12
   904    11  6.1520E-20  1.5000E+15  0.0000E+00  0.0000E+00  0.0000E+00  6 13
  1001    11  3.0000E-20  1.3500E+16  0.0000E+00  0.0000E+00  0.0000E+00  6 14
```

```
1004    11  6.2960E-21  1.9200E+15  0.0000E+00  0.0000E+00  0.0000E+00  6 15
1101    11  2.3200E-20  2.5500E+16  0.0000E+00  0.0000E+00  0.0000E+00  6 16
1102    11  3.8500E-20  1.1600E+16  0.0000E+00  0.0000E+00  0.0000E+00  6 17
1103    11  1.5200E-22  7.1000E+15  0.0000E+00  0.0000E+00  0.0000E+00  6 18
1104    11  2.6500E-22  6.5000E+15  0.0000E+00  0.0000E+00  0.0000E+00  6 19
1106    11  1.6500E-22  1.7500E+15  0.0000E+00  0.0000E+00  0.0000E+00  6 20
1107    11  2.5000E-21  1.4300E+15  0.0000E+00  0.0000E+00  0.0000E+00  6 21
1201    11  1.1100E-19  3.2000E+16  0.0000E+00  0.0000E+00  0.0000E+00  6 22
1203    11  2.2300E-21  1.0400E+16  0.0000E+00  0.0000E+00  0.0000E+00  6 23
1208    11  1.9600E-21  1.4100E+15  0.0000E+00  0.0000E+00  0.0000E+00  6 24
1312    11  2.1200E-23  1.3800E+15  0.0000E+00  0.0000E+00  0.0000E+00  6 25
1413    11  2.6580E-25  1.3800E+15  0.0000E+00  0.0000E+00  0.0000E+00  6 26
1514    11  3.6090E-27  1.3800E+15  0.0000E+00  0.0000E+00  0.0000E+00  6 27
1615    11  5.4850E-29  1.3800E+15  0.0000E+00  0.0000E+00  0.0000E+00  6 28
1716    11  9.4950E-31  1.3800E+15  0.0000E+00  0.0000E+00  0.0000E+00  6 29
1817    11  1.8720E-32  1.3800E+15  0.0000E+00  0.0000E+00  0.0000E+00  6 30
CARBON M                        3   3    28.00       .4000E-14       .2000E-14
  11     0       .0000     1.93100                                        7  1
  11     1    2143.3000    1.93100                                        7  2
  11     0    4260.1001    1.93100                                        7  3
 201    11  9.7000E-18  1.2500E+16  0.0000E+00  0.0000E+00  0.0000E+00  7  1
 301    11  6.9900E-20  7.4000E+16  0.0000E+00  0.0000E+00  0.0000E+00  7  2
 302    11  5.8000E-22  1.2000E+16  0.0000E+00  0.0000E+00  0.0000E+00  7  3
```

This is part of the INSPEC file. INSPEC is reqiured by the spctra routine in HAIRM. The first line of the file includes parameters which where used in the BGNDx calclations, if these parameters have not changed HAIRM-87 will not re-run the BGNDx modules. The rest of the file contains band radiances for all supported bands. In this sample output we have printed only the band radiance information for the 01101 to 00001 CO_2 transition centered at 14.98 μm.

.10000E+02	3	3	.10000E+04	1	ATM1976.DAT
60.	1.9848E-06		60.	2.5384E-06	4.2477E-06
60.	2.2355E+02		60.	2.4157E+02	2.4372E+02
60.	1.0587E+20		60.	1.4175E+18	5.2935E+19
62.	1.8164E-06		62.	2.1956E-06	3.7578E-06
62.	2.2026E+02		62.	2.3604E+02	2.3823E+02
62.	8.1624E+19		62.	1.0802E+18	4.0812E+19
64.	1.6599E-06		64.	1.8845E-06	3.3068E-06
64.	2.1718E+02		64.	2.3051E+02	2.3275E+02
64.	6.2546E+19		64.	8.1793E+17	3.1272E+19
66.	1.5151E-06		66.	1.6038E-06	2.8941E-06
66.	2.1436E+02		66.	2.2500E+02	2.2728E+02
66.	4.7618E+19		66.	6.1522E+17	2.3809E+19
68.	1.3818E-06		68.	1.3514E-06	2.5173E-06
68.	2.1185E+02		68.	2.1955E+02	2.2181E+02
68.	3.6006E+19		68.	4.5950E+17	1.8003E+19
70.	1.2599E-06		70.	1.1241E-06	2.1695E-06
70.	2.0973E+02		70.	2.1433E+02	2.1646E+02
70.	2.7024E+19		70.	3.4065E+17	1.3512E+19
72.	1.1525E-06		72.	9.2724E-07	1.8370E-06
72.	2.0816E+02		72.	2.0980E+02	2.1187E+02
72.	2.0105E+19		72.	2.5066E+17	1.0052E+19
74.	1.0574E-06		74.	7.6837E-07	1.5906E-06
74.	2.0706E+02		74.	2.0578E+02	2.0796E+02
74.	1.4838E+19		74.	1.8324E+17	7.4186E+18
76.	9.7046E-07		76.	6.2841E-07	1.3677E-06
76.	2.0628E+02		76.	2.0179E+02	2.0406E+02
76.	1.0388E+19		76.	1.3316E+17	5.4439E+18
78.	8.9193E-07		78.	5.0708E-07	1.1661E-06
78.	2.0587E+02		78.	1.9789E+02	2.0017E+02
78.	7.9421E+18		78.	9.6168E+16	3.9710E+18
80.	8.2119E-07		80.	4.0363E-07	9.9012E-07
80.	2.0587E+02		80.	1.9419E+02	1.9630E+02
80.	5.7565E+18		80.	6.9001E+16	2.8782E+18
82.	7.5871E-07		82.	3.1828E-07	8.2954E-07
82.	2.0631E+02		82.	1.9100E+02	1.9248E+02
82.	4.1442E+18		82.	4.9169E+16	2.0721E+18
84.	7.0539E-07		84.	2.5177E-07	6.9805E-07
84.	2.0723E+02		84.	1.8908E+02	1.8880E+02
84.	2.9608E+18		84.	3.4773E+16	1.4804E+18
86.	6.6126E-07		86.	2.0085E-07	5.9703E-07
86.	2.0880E+02		86.	1.8929E+02	1.8707E+02
86.	2.0924E+18		86.	2.4415E+16	1.0462E+18
88.	6.2311E-07		88.	1.5958E-07	5.3522E-07

88.	2.1089E+02	88.	1.9104E+02	1.8720E+02
88.	1.4658E+18	88.	1.7076E+16	7.3287E+17
90.	5.8748E-07	90.	1.2475E-07	4.8182E-07
90.	2.1326E+02	90.	1.9391E+02	1.8750E+02
90.	1.0262E+18	90.	1.1931E+16	5.1310E+17
92.	5.5487E-07	92.	9.6457E-08	4.3107E-07
92.	2.1601E+02	92.	1.9818E+02	1.8832E+02
92.	7.1751E+17	92.	8.3243E+15	3.5874E+17
94.	5.2646E-07	94.	7.4021E-08	3.9320E-07
94.	2.1911E+02	94.	2.0410E+02	1.9002E+02
94.	5.0078E+17	94.	5.8004E+15	2.5039E+17
96.	4.9963E-07	96.	5.6164E-08	3.6579E-07
96.	2.2278E+02	96.	2.1179E+02	1.9274E+02
96.	3.4917E+17	96.	4.0382E+15	1.7458E+17
98.	4.7310E-07	98.	4.2303E-08	3.3696E-07
98.	2.2720E+02	98.	2.2138E+02	1.9673E+02
98.	2.4342E+17	98.	2.8091E+15	1.2170E+17
100.	4.4851E-07	100.	3.1833E-08	3.1244E-07
100.	2.3240E+02	100.	2.3303E+02	2.0226E+02
100.	1.6971E+17	100.	1.9518E+15	8.4855E+16
102.	4.2425E-07	102.	2.3962E-08	2.9098E-07
102.	2.3876E+02	102.	2.4681E+02	2.0976E+02
102.	1.1832E+17	102.	1.3529E+15	5.9156E+16
104.	4.0074E-07	104.	1.8088E-08	2.6959E-07
104.	2.4663E+02	104.	2.6292E+02	2.1997E+02
104.	8.2377E+16	104.	9.3352E+14	4.1187E+16
106.	3.7776E-07	106.	1.3668E-08	2.5039E-07
106.	2.5665E+02	106.	2.8166E+02	2.3353E+02
106.	5.7099E+16	106.	6.3888E+14	2.8549E+16
108.	3.5134E-07	108.	1.0262E-08	2.2750E-07
108.	2.7032E+02	108.	3.0354E+02	2.5189E+02
108.	3.9110E+16	108.	4.3091E+14	1.9555E+16
110.	3.1845E-07	110.	7.6182E-09	1.9915E-07
110.	2.8899E+02	110.	3.2837E+02	2.7607E+02
110.	2.5760E+16	110.	2.8667E+14	1.2880E+16
112.	2.7510E-07	112.	5.6383E-09	1.6500E-07
112.	3.1186E+02	112.	3.5448E+02	3.0338E+02
112.	1.6521E+16	112.	1.9304E+14	8.2604E+15
114.	2.2935E-07	114.	4.2159E-09	1.3215E-07
114.	3.3558E+02	114.	3.8006E+02	3.2995E+02
114.	1.1018E+16	114.	1.3461E+14	5.5087E+15
116.	1.8622E-07	116.	3.1827E-09	1.0377E-07
116.	3.5967E+02	116.	4.0508E+02	3.5583E+02
116.	7.5931E+15	116.	9.6657E+13	3.7965E+15
118.	1.4862E-07	118.	2.4248E-09	8.0690E-08
118.	3.8372E+02	118.	4.2939E+02	3.8104E+02
118.	5.3826E+15	118.	7.1168E+13	2.6912E+15
120.	1.1752E-07	120.	1.8636E-09	6.2572E-08
120.	4.0736E+02	120.	4.5286E+02	4.0545E+02
120.	3.9106E+15	120.	5.3546E+13	1.9553E+15
122.	9.2492E-08	122.	1.4442E-09	4.8539E-08
122.	4.3029E+02	122.	4.7540E+02	4.2890E+02
122.	2.9036E+15	122.	4.1047E+13	1.4518E+15
124.	7.2704E-08	124.	1.1282E-09	3.7744E-08
124.	4.5239E+02	124.	4.9701E+02	4.5136E+02

124.	2.1971E+15	124.	3.1975E+13	1.0985E+15
126.	5.7283E-08	126.	8.8838E-10	2.9498E-08
126.	4.7361E+02	126.	5.1769E+02	4.7284E+02
126.	1.6898E+15	126.	2.5253E+13	8.4487E+14
128.	4.5273E-08	128.	7.0490E-10	2.3170E-08
128.	4.9404E+02	128.	5.3748E+02	4.9343E+02
128.	1.3180E+15	128.	2.0186E+13	6.5899E+14
130.	3.5975E-08	130.	5.6347E-10	1.8326E-08
130.	5.1356E+02	130.	5.5639E+02	5.1309E+02
130.	1.0409E+15	130.	1.6306E+13	5.2042E+14
132.	2.8743E-08	132.	4.5337E-10	1.4588E-08
132.	5.3239E+02	132.	5.7452E+02	5.3201E+02
132.	8.3083E+14	132.	1.3295E+13	4.1540E+14
134.	2.3058E-08	134.	3.6698E-10	1.1671E-08
134.	5.5051E+02	134.	5.9189E+02	5.5021E+02
134.	6.6961E+14	134.	1.0932E+13	3.3480E+14
136.	1.8595E-08	136.	2.9880E-10	9.3910E-09
136.	5.6791E+02	136.	6.0852E+02	5.6768E+02
136.	5.4443E+14	136.	9.0573E+12	2.7221E+14
138.	1.5060E-08	138.	2.4463E-10	7.5922E-09
138.	5.8469E+02	138.	6.2444E+02	5.8450E+02
138.	4.4610E+14	138.	7.5562E+12	2.2305E+14
140.	1.2258E-08	140.	2.0137E-10	6.1709E-09
140.	6.0084E+02	140.	6.3966E+02	6.0068E+02
140.	3.6814E+14	140.	6.3439E+12	1.8407E+14
142.	1.0025E-08	142.	1.6661E-10	5.0411E-09
142.	6.1640E+02	142.	6.5422E+02	6.1628E+02
142.	3.0573E+14	142.	5.3573E+12	1.5286E+14
144.	8.2285E-09	144.	1.3851E-10	4.1340E-09
144.	6.3148E+02	144.	6.6816E+02	6.3138E+02
144.	2.5533E+14	144.	4.5484E+12	1.2767E+14
146.	6.7750E-09	146.	1.1565E-10	3.4011E-09
146.	6.4623E+02	146.	6.8152E+02	6.4614E+02
146.	2.1418E+14	146.	3.8801E+12	1.0709E+14
148.	5.5741E-09	148.	9.6673E-11	2.7965E-09
148.	6.6110E+02	148.	6.9473E+02	6.6103E+02
148.	1.7993E+14	148.	3.3172E+12	8.9962E+13
150.	4.3440E-09	150.	8.2833E-11	2.1780E-09
150.	6.8248E+02	150.	7.0470E+02	6.8245E+02
150.	1.4483E+14	150.	2.8945E+12	7.2416E+13
160.	1.7981E-09	160.	3.5156E-11	9.0019E-10
160.	7.3771E+02	160.	7.5771E+02	7.3770E+02
160.	6.6389E+13	160.	1.3712E+12	3.3195E+13
170.	7.9610E-10	170.	1.5921E-11	3.9829E-10
170.	7.8303E+02	170.	8.0066E+02	7.8302E+02
170.	3.2664E+13	170.	6.9218E+11	1.6332E+13
180.	3.7169E-10	180.	7.5836E-12	1.8590E-10
180.	8.2021E-02	180.	8.3545E+02	8.2021E+02
180.	1.6905E+13	180.	3.6562E+11	8.4526E+12
190	1.8114E-10	190.	3.7616E-12	9.0585E-11
190.	8.5062E+02	190.	8.6347E+02	8.5062E+02
190.	9.0849E+12	190.	1.9972E+11	4.5424E+12
200.	9.1504E-11	200.	1.9290E-12	4.5756E-11
200.	8.7485E+02	200.	8.8570E+02	8.7485E+02
200.	5.0261E+12	200.	1.1192E+11	2.5130E+12

210.	4.7568E-11	210.	1.0160E-12	2.3785E-11
210.	8.9492E+02	210.	9.0358E+02	8.9492E+02
210.	2.8424E+12	210.	6.3960E+10	1.4212E+12
220.	2.5283E-11	220.	5.4691E-13	1.2642E-11
220.	9.0912E+02	220.	9.1695E+02	9.0912E+02
220.	1.6368E+12	220.	3.7125E+10	8.1838E+11
230.	1.3744E-11	230.	3.0056E-13	6.8718E-12
230.	9.1914E+02	230.	9.2819E+02	9.1914E+02
230.	9.5686E+11	230.	2.1806E+10	4.7843E+11
240.	7.6011E-12	240.	1.6800E-13	3.8006E-12
240.	9.3254E+02	240.	9.4124E+02	9.3254E+02
240.	5.6219E+11	240.	1.2891E+10	2.8109E+11
250.	4.2714E-12	250.	9.5410E-14	2.1357E-12
250.	9.4772E+02	250.	9.5383E+02	9.4772E+02
250.	3.3247E+11	250.	7.6838E+09	1.6623E+11

This output is from the INPEN file for test case one. The INPEN file is created in the spctra module of HAIRM-87 and is required by the trypen plotting package. This part of the INPEN file contains the spectral radiance for a limb path at 60 km. The points are spaced every 2 cm^{-1} from 250 to 6000 cm^{-1}.

1	60	250	2.053E-06	2.747E-06	3.953E-06	2.358E-06	7.511E-07	1.481E-08
1	60	262	6.041E-08	1.542E-07	2.317E-07	1.461E-07	5.409E-08	1.141E-07
1	60	274	6.069E-07	1.570E-06	2.332E-06	2.236E-06	1.926E-06	9.236E-07
1	60	286	5.362E-07	5.071E-07	6.332E-07	3.509E-07	6.834E-08	5.416E-09
1	60	298	3.748E-08	5.412E-07	1.048E-06	1.005E-06	4.956E-07	2.141E-08
1	60	310	2.989E-08	1.484E-07	2.679E-07	2.397E-07	1.132E-07	2.988E-07
1	60	322	7.399E-07	1.085E-06	7.306E-07	3.429E-07	1.275E-07	3.139E-07
1	60	334	5.767E-07	5.907E-07	3.201E-07	6.372E-08	5.138E-08	5.436E-08
1	60	346	6.914E-08	7.194E-08	8.009E-08	7.166E-08	1.876E-07	3.200E-07
1	60	358	3.476E-07	1.815E-07	2.174E-08	2.019E-10	3.445E-08	1.029E-07
1	60	370	1.720E-07	1.075E-07	4.391E-08	9.899E-09	5.768E-09	3.946E-09
1	60	382	9.426E-08	2.067E-07	2.444E-07	1.317E-07	2.145E-08	6.189E-09
1	60	394	3.207E-08	5.865E-08	5.037E-08	2.371E-08	2.028E-09	2.008E-10
1	60	406	6.822E-11	3.787E-11	7.517E-12	3.696E-11	6.357E-09	5.862E-08
1	60	418	1.322E-07	1.632E-07	9.118E-08	2.875E-08	1.223E-08	2.428E-08
1	60	430	3.616E-08	3.546E-08	1.840E-08	1.345E-09	1.751E-08	4.966E-08
1	60	442	7.749E-08	4.683E-08	1.467E-08	9.837E-12	4.191E-11	2.827E-10
1	60	454	1.045E-08	2.509E-08	3.364E-08	1.897E-08	4.511E-09	2.281E-11
1	60	466	2.884E-11	3.212E-09	1.503E-08	2.688E-08	2.058E-08	8.713E-09
1	60	478	3.471E-11	8.169E-09	2.426E-08	4.012E-08	2.402E-08	8.060E-09
1	60	490	4.154E-10	6.983E-10	4.352E-10	1.520E-10	2.202E-10	8.113E-10
1	60	502	1.676E-09	8.523E-09	1.522E-08	1.432E-08	7.073E-09	1.126E-10
1	60	514	5.149E-10	1.314E-09	2.075E-09	1.952E-09	1.686E-09	2.432E-09
1	60	526	3.527E-09	2.288E-09	1.041E-09	9.593E-10	2.289E-09	3.601E-09
1	60	538	2.960E-09	2.183E-09	3.796E-09	6.557E-09	6.980E-09	4.126E-09
1	60	550	1.301E-09	9.465E-10	1.319E-09	1.262E-09	9.935E-10	2.095E-09
1	60	562	3.697E-09	5.170E-09	5.308E-09	4.841E-09	4.392E-09	3.918E-09
1	60	574	4.628E-09	5.995E-09	7.424E-09	8.936E-09	1.049E-08	1.221E-08
1	60	586	1.371E-08	1.539E-08	1.691E-08	1.937E-08	4.330E-08	6.921E-08
1	60	598	7.238E-08	4.617E-08	2.221E-08	2.173E-08	2.378E-08	2.505E-08
1	60	610	2.559E-08	2.649E-08	5.474E-08	9.503E-08	1.187E-07	7.764E-08
1	60	622	1.052E-08	3.214E-08	3.595E-08	3.905E-08	4.151E-08	4.399E-08
1	60	634	4.582E-08	4.719E-08	4.810E-08	4.821E-08	4.702E-08	7.506E-08
1	60	646	1.156E-07	1.373E-07	1.039E-07	6.778E-08	5.889E-08	6.018E-08
1	60	658	6.019E-08	5.783E-08	5.344E-08	9.337E-08	2.092E-07	3.323E-07
1	60	670	2.770E-07	1.646E-07	8.396E-08	7.325E-08	7.149E-08	7.064E-08
1	60	682	6.755E-08	6.544E-08	8.570E-08	1.090E-07	1.106E-07	8.411E-08
1	60	694	5.705E-08	5.178E-08	4.954E-08	4.753E-08	4.626E-08	4.562E-08
1	60	706	4.622E-08	4.675E-08	4.639E-08	4.505E-08	4.387E-08	5.772E-08
1	60	718	9.432E-08	1.255E-07	8.718E-08	5.716E-08	3.260E-08	3.429E-08
1	60	730	3.615E-08	3.441E-08	3.338E-08	3.349E-08	4.928E-08	6.968E-08
1	60	742	7.633E-08	4.950E-08	2.319E-08	1.694E-08	1.705E-08	1.562E-08
1	60	754	1.427E-08	1.320E-08	1.202E-08	1.029E-08	8.801E-09	7.715E-09
1	60	766	6.591E-09	5.563E-09	4.735E-09	4.303E-09	3.829E-09	3.474E-09
1	60	778	3.275E-09	2.966E-09	2.737E-09	2.405E-09	2.028E-09	4.048E-09
1	60	790	7.966E-09	1.103E-08	7.347E-09	3.366E-09	1.866E-09	1.994E-09
1	60	802	1.939E-09	1.867E-09	1.779E-09	1.596E-09	1.350E-09	1.134E-09
1	60	814	9.518E-10	7.362E-10	5.620E-10	4.301E-10	3.301E-10	2.450E-10

1	60	826	1.789E-10	1.350E-10	1.033E-10	7.908E-11	5.985E-11	4.975E-11
1	60	838	4.550E-11	4.118E-11	3.691E-11	3.322E-11	3.086E-11	2.771E-11
1	60	850	2.444E-11	2.171E-11	1.944E-11	1.763E-11	1.734E-11	1.708E-11
1	60	862	1.545E-11	1.463E-11	1.740E-11	2.333E-11	2.917E-11	3.330E-11
1	60	874	3.576E-11	3.672E-11	3.671E-11	3.545E-11	3.289E-11	3.083E-11
1	60	886	3.014E-11	3.239E-11	3.412E-11	3.263E-11	2.950E-11	3.379E-11
1	60	898	4.665E-11	6.182E-11	7.427E-11	8.276E-11	8.708E-11	8.823E-11
1	60	910	8.648E-11	8.325E-11	8.168E-11	8.747E-11	1.041E-10	1.213E-10
1	60	922	1.359E-10	1.622E-10	2.129E-10	2.849E-10	3.648E-10	4.479E-10
1	60	934	5.350E-10	6.248E-10	7.196E-10	8.238E-10	9.420E-10	1.055E-09
1	60	946	1.137E-09	1.157E-09	1.170E-09	1.153E-09	1.076E-09	9.253E-10
1	60	958	7.096E-10	5.624E-10	6.195E-10	8.704E-10	1.239E-09	1.562E-09
1	60	970	1.832E-09	2.069E-09	2.210E-09	2.421E-09	2.632E-09	2.975E-09
1	60	982	3.485E-09	4.212E-09	5.380E-09	6.947E-09	9.190E-09	1.200E-08
1	60	994	1.566E-08	2.012E-08	2.561E-08	3.207E-08	3.944E-08	4.759E-08
1	60	1006	5.639E-08	6.560E-08	7.523E-08	8.477E-08	9.320E-08	1.005E-07
1	60	1018	1.069E-07	1.124E-07	1.163E-07	1.181E-07	1.182E-07	1.183E-07
1	60	1030	1.204E-07	1.277E-07	1.410E-07	1.613E-07	1.782E-07	1.626E-07
1	60	1042	1.153E-07	8.260E-08	9.744E-08	1.380E-07	1.667E-07	1.813E-07
1	60	1054	1.859E-07	1.836E-07	1.739E-07	1.561E-07	1.290E-07	9.378E-08
1	60	1066	5.847E-08	3.137E-08	1.514E-08	7.922E-09	5.526E-09	4.880E-09
1	60	1078	4.609E-09	4.474E-09	4.409E-09	4.002E-09	3.739E-09	3.764E-09
1	60	1090	3.513E-09	3.306E-09	3.217E-09	2.991E-09	2.737E-09	2.531E-09
1	60	1102	2.408E-09	2.238E-09	2.119E-09	2.178E-09	2.317E-09	2.543E-09
1	60	1114	2.807E-09	3.124E-09	3.515E-09	3.714E-09	3.943E-09	4.106E-09
1	60	1126	4.016E-09	3.779E-09	3.496E-09	3.250E-09	3.018E-09	2.783E-09
1	60	1138	2.451E-09	2.041E-09	1.772E-09	1.702E-09	1.616E-09	1.521E-09
1	60	1150	1.413E-09	1.256E-09	1.166E-09	1.134E-09	1.093E-09	1.027E-09
1	60	1162	9.530E-10	8.832E-10	8.110E-10	7.341E-10	6.836E-10	6.554E-10
1	60	1174	6.209E-10	5.456E-10	4.753E-10	4.077E-10	3.590E-10	3.364E-10
1	60	1186	3.247E-10	2.952E-10	2.465E-10	2.011E-10	1.691E-10	1.408E-10
1	60	1198	1.202E-10	1.036E-10	8.859E-11	7.609E-11	6.601E-11	7.122E-11
1	60	1210	9.031E-11	1.056E-10	7.900E-11	5.510E-11	4.639E-11	3.673E-11
1	60	1222	4.959E-11	6.651E-11	6.651E-11	3.765E-11	8.822E-12	5.874E-12
1	60	1234	4.228E-12	4.462E-12	5.444E-12	2.076E-11	5.358E-11	8.610E-11
1	60	1246	5.619E-11	2.262E-11	4.543E-12	5.372E-12	4.292E-12	3.833E-11
1	60	1258	1.462E-10	2.517E-10	1.929E-10	1.106E-10	9.724E-11	2.251E-10
1	60	1270	3.522E-10	3.750E-10	1.924E-10	5.334E-11	1.094E-11	2.175E-11
1	60	1282	2.686E-11	6.772E-11	1.221E-10	1.580E-10	1.103E-10	4.768E-11
1	60	1294	2.717E-11	3.307E-11	2.748E-11	1.241E-11	1.230E-12	2.319E-11
1	60	1306	7.563E-11	1.479E-10	2.719E-10	4.484E-10	5.834E-10	8.109E-10
1	60	1318	9.971E-10	9.394E-10	4.743E-10	9.586E-11	2.343E-11	2.880E-11
1	60	1330	3.976E-11	6.798E-11	3.464E-10	1.146E-09	1.981E-09	2.126E-09
1	60	1342	1.188E-09	3.374E-10	1.176E-10	2.554E-10	3.187E-10	3.149E-10
1	60	1351	3.208E-10	2.946E-10	6.635E-10	1.770E-09	2.647E-09	2.251E-09
1	60	1366	1.215E-09	6.682E-10	7.863E-10	1.293E-09	1.780E-09	1.538E-09
1	60	1378	9.164E-10	3.550E-10	2.101E-10	7.923E-10	1.693E-09	2.067E-09
1	60	1390	1.353E-09	1.328E-09	2.229E-09	2.772E-09	2.389E-09	1.414E-09
1	60	1402	9.781E-10	8.185E-10	8.043E-10	5.523E-10	3.602E-10	4.787E-10
1	60	1414	7.361E-10	2.126E-09	3.356E-09	3.504E-09	2.380E-09	1.574E-09
1	60	1426	1.087E-09	9.704E-10	1.215E-09	1.199E-09	2.146E-09	3.084E-09
1	60	1438	2.495E-09	1.119E-09	3.281E-11	2.821E-10	7.105E-10	1.126E-09
1	60	1450	9.092E-10	1.175E-09	2.513E-09	4.225E-09	4.242E-09	2.492E-09
1	60	1462	1.094E-09	9.218E-10	8.501E-10	7.442E-10	1.213E-09	2.351E-09
1	60	1474	2.630E-09	2.243E-09	1.326E-09	8.355E-10	5.430E-10	6.719E-10

1	60	1486	1.330E-09	2.314E-09	2.559E-09	1.658E-09	1.083E-09	1.587E-09
1	60	1498	1.994E-09	1.653E-09	1.254E-09	1.913E-09	3.676E-09	4.453E-09
1	60	1510	3.863E-09	2.745E-09	2.542E-09	3.039E-09	3.738E-09	4.095E-09
1	60	1522	3.731E-09	3.017E-09	2.251E-09	1.804E-09	1.588E-09	1.773E-09
1	60	1534	1.838E-09	2.073E-09	2.875E-09	3.652E-09	3.677E-09	2.455E-09
1	60	1546	1.648E-09	1.108E-09	1.112E-09	1.035E-09	1.520E-09	2.538E-09
1	60	1558	3.600E-09	3.054E-09	1.716E-09	8.684E-10	9.531E-10	1.212E-09
1	60	1570	1.187E-09	7.944E-10	6.591E-10	9.448E-10	7.244E-10	3.228E-10
1	60	1582	5.072E-11	1.822E-11	4.702E-11	1.421E-10	2.845E-10	4.431E-10
1	60	1594	5.679E-10	5.172E-10	3.641E-10	3.829E-10	4.969E-10	6.215E-10
1	60	1606	7.046E-10	7.463E-10	6.115E-10	2.793E-10	3.613E-10	6.021E-10
1	60	1618	5.946E-10	6.700E-10	8.182E-10	9.930E-10	7.981E-10	6.124E-10
1	60	1630	3.150E-10	4.893E-10	1.077E-09	1.550E-09	1.344E-09	7.233E-10
1	60	1642	4.753E-10	7.367E-10	1.261E-09	1.372E-09	1.578E-09	2.071E-09
1	60	1654	2.090E-09	1.231E-09	3.865E-10	3.833E-10	5.773E-10	5.182E-10
1	60	1666	6.754E-10	1.197E-09	1.554E-09	1.547E-09	1.165E-09	1.024E-09
1	60	1678	7.999E-10	9.308E-10	1.280E-09	1.504E-09	1.153E-09	8.345E-10
1	60	1690	5.761E-10	5.601E-10	7.999E-10	1.361E-09	1.830E-09	2.112E-09
1	60	1702	1.722E-09	1.336E-09	1.013E-09	8.098E-10	6.107E-10	6.275E-10
1	60	1714	9.855E-10	1.270E-09	1.310E-09	8.706E-10	4.870E-10	2.543E-10
1	60	1726	2.762E-10	4.079E-10	8.140E-10	1.128E-09	1.301E-09	1.013E-09
1	60	1738	7.339E-10	7.327E-10	7.782E-10	9.023E-10	1.022E-09	1.217E-09
1	60	1750	1.203E-09	8.910E-10	5.173E-10	3.410E-10	3.689E-10	3.761E-10
1	60	1762	3.586E-10	2.855E-10	3.581E-10	6.560E-10	7.926E-10	8.277E-10
1	60	1774	6.037E-10	4.197E-10	3.824E-10	4.787E-10	5.235E-10	4.662E-10
1	60	1786	3.081E-10	2.875E-10	3.970E-10	5.897E-10	5.557E-10	4.794E-10
1	60	1798	4.389E-10	5.311E-10	4.891E-10	3.321E-10	2.266E-10	2.739E-10
1	60	1810	3.394E-10	3.014E-10	2.032E-10	1.362E-10	1.362E-10	1.330E-10
1	60	1822	2.325E-10	3.566E-10	4.915E-10	5.419E-10	5.282E-10	3.638E-10
1	60	1834	2.317E-10	2.204E-10	2.319E-10	2.609E-10	4.268E-10	6.264E-10
1	60	1846	5.482E-10	3.681E-10	2.028E-10	1.379E-10	1.238E-10	1.205E-10
1	60	1858	1.233E-10	1.206E-10	1.068E-10	1.856E-10	3.629E-10	5.058E-10
1	60	1870	3.949E-10	1.963E-10	7.895E-11	6.514E-11	4.384E-11	3.165E-11
1	60	1882	5.447E-11	9.477E-11	1.402E-10	2.070E-10	2.419E-10	2.229E-10
1	60	1894	2.300E-10	2.224E-10	2.031E-10	1.979E-10	2.141E-10	2.631E-10
1	60	1906	3.167E-10	3.647E-10	3.804E-10	3.445E-10	3.527E-10	4.350E-10
1	60	1918	5.308E-10	4.695E-10	4.041E-10	3.153E-10	2.246E-10	1.497E-10
1	60	1930	2.471E-10	3.762E-10	3.761E-10	2.292E-10	9.868E-11	1.320E-10
1	60	1942	1.990E-10	1.887E-10	1.369E-10	6.265E-11	3.551E-11	2.832E-11
1	60	1954	3.367E-11	3.426E-11	3.159E-11	2.796E-11	2.896E-11	4.852E-11
1	60	1966	7.297E-11	7.283E-11	3.983E-11	1.090E-11	5.566E-12	5.265E-12
1	60	1978	3.783E-12	2.539E-12	1.790E-12	4.232E-12	1.295E-11	3.839E-11
1	60	1990	6.813E-11	9.171E-11	5.603E-11	2.476E-11	9.951E-12	9.531E-12
1	60	2002	6.446E-12	4.236E-12	6.038E-12	7.610E-12	7.400E-12	7.426E-12
1	60	2014	1.878E-11	3.420E-11	3.628E-11	2.467E-11	1.166E-11	1.085E-11
1	60	2026	1.240E-11	1.273E-11	1.350E-11	1.559E-11	2.049E-11	2.665E-11
1	60	2038	4.034E-11	6.050E-11	7.898E-11	9.448E-11	1.121E-10	1.274E-10
1	60	2050	1.420E-10	1.575E-10	1.648E-10	1.715E-10	1.807E-10	1.910E-10
1	60	2062	1.993E-10	2.072E-10	2.149E-10	2.164E-10	2.129E-10	1.951E-10
1	60	2074	3.663E-10	6.095E-10	7.186E-10	5.060E-10	2.792E-10	2.376E-10
1	60	2086	2.518E-10	2.634E-10	2.768E-10	2.846E-10	2.911E-10	2.957E-10
1	60	2098	2.961E-10	2.914E-10	2.834E-10	2.865E-10	3.034E-10	2.982E-10
1	60	2110	2.392E-10	1.770E-10	1.915E-10	2.862E-10	3.784E-10	4.379E-10
1	60	2122	4.479E-10	4.231E-10	3.604E-10	2.816E-10	1.894E-10	1.140E-10
1	60	2134	5.903E-11	3.727E-11	2.670E-11	2.015E-11	1.035E-11	9.950E-12

1	60	2146	1.613E-11	2.479E-11	2.758E-11	2.798E-11	3.110E-11	2.880E-11
1	60	2158	3.346E-11	2.948E-11	3.539E-11	2.975E-11	3.397E-11	3.079E-11
1	60	2170	3.242E-11	3.280E-11	3.071E-11	3.459E-11	2.952E-11	3.412E-11
1	60	2182	2.985E-11	3.072E-11	3.031E-11	2.657E-11	2.999E-11	2.446E-11
1	60	2194	2.543E-11	2.404E-11	2.093E-11	2.284E-11	1.856E-11	1.776E-11
1	60	2206	1.671E-11	1.326E-11	1.271E-11	1.031E-11	8.276E-12	7.511E-12
1	60	2218	5.723E-12	4.740E-12	4.121E-12	3.102E-12	2.607E-12	2.244E-12
1	60	2230	1.780E-12	1.485E-12	1.302E-12	1.061E-12	7.967E-13	6.665E-13
1	60	2242	6.019E-13	4.683E-13	3.888E-13	3.651E-13	2.778E-13	2.588E-13
1	60	2254	3.233E-13	3.409E-13	3.749E-13	4.982E-13	7.337E-13	1.181E-12
1	60	2266	1.989E-12	3.273E-12	5.242E-12	8.407E-12	1.265E-11	1.788E-11
1	60	2278	2.396E-11	3.076E-11	3.801E-11	4.682E-11	5.807E-11	7.228E-11
1	60	2290	9.005E-11	1.118E-10	1.388E-10	1.705E-10	2.059E-10	2.454E-10
1	60	2302	2.884E-10	3.349E-10	3.835E-10	4.305E-10	4.688E-10	4.955E-10
1	60	2314	5.088E-10	5.024E-10	4.677E-10	4.156E-10	3.538E-10	2.962E-10
1	60	2326	2.504E-10	2.752E-10	3.626E-10	4.744E-10	5.737E-10	6.365E-10
1	60	2338	6.329E-10	5.975E-10	5.390E-10	4.764E-10	3.979E-10	3.211E-10
1	60	2350	2.611E-10	2.151E-10	1.823E-10	1.597E-10	1.434E-10	1.356E-10
1	60	2362	1.272E-10	1.192E-10	1.080E-10	9.554E-11	8.353E-11	7.522E-11
1	60	2374	7.112E-11	7.018E-11	6.965E-11	6.857E-11	6.721E-11	6.461E-11
1	60	2386	5.849E-11	4.609E-11	2.780E-11	1.156E-11	2.702E-12	2.571E-13
1	60	2398	1.018E-14	2.872E-16	2.195E-16	3.917E-16	3.187E-16	2.455E-16
1	60	2410	1.955E-16	1.189E-16	5.146E-17	4.671E-18	7.704E-17	1.851E-16
1	60	2422	2.391E-16	1.468E-16	6.612E-17	9.304E-17	1.628E-16	1.225E-16
1	60	2434	9.792E-17	9.585E-17	1.192E-16	7.648E-17	2.990E-17	8.338E-18
1	60	2446	5.058E-18	6.664E-18	8.771E-18	7.692E-18	2.969E-17	6.007E-17
1	60	2458	7.264E-17	8.697E-17	1.068E-16	1.134E-16	6.712E-17	3.376E-17
1	60	2470	4.483E-17	4.390E-17	2.126E-17	3.476E-18	6.768E-18	1.794E-17
1	60	2482	4.368E-17	7.225E-17	8.741E-17	4.986E-17	1.562E-17	2.566E-18
1	60	2494	1.961E-17	4.180E-17	4.769E-17	2.639E-17	4.627E-18	1.100E-18
1	60	2506	3.056E-18	1.696E-17	3.033E-17	3.400E-17	3.151E-17	2.982E-17
1	60	2518	2.813E-17	2.768E-17	2.089E-17	1.312E-17	4.483E-18	8.406E-19
1	60	2530	2.747E-21	5.645E-18	1.592E-17	2.860E-17	2.385E-17	1.697E-17
1	60	2542	1.267E-17	1.393E-17	1.206E-17	8.188E-18	3.016E-18	4.924E-19
1	60	2554	7.017E-19	1.652E-18	2.229E-18	1.550E-18	1.746E-18	2.592E-18
1	60	2566	8.123E-18	1.383E-17	1.518E-17	9.348E-18	1.245E-17	2.056E-17
1	60	2578	1.917E-17	1.111E-17	3.840E-18	3.300E-18	1.929E-18	1.123E-18
1	60	2590	3.153E-18	6.348E-18	1.193E-17	1.678E-17	1.878E-17	1.243E-17
1	60	2602	5.084E-18	1.652E-18	4.034E-18	6.948E-18	1.292E-17	1.953E-17
1	60	2614	2.461E-17	2.025E-17	1.233E-17	2.030E-17	3.090E-17	2.470E-17
1	60	2626	1.141E-17	5.935E-18	1.088E-17	1.072E-17	7.808E-18	7.504E-18
1	60	2638	1.512E-17	1.705E-17	1.541E-17	1.038E-17	6.062E-18	5.026E-18
1	60	2650	2.761E-18	1.297E-18	4.908E-19	1.539E-18	2.601E-18	2.680E-18
1	60	2662	2.250E-18	1.409E-18	5.569E-18	2.525E-17	4.553E-17	3.867E-17
1	60	2674	3.152E-17	4.135E-17	6.204E-17	6.199E-17	4.955E-17	2.182E-17
1	60	2686	6.112E-18	1.832E-18	4.311E-17	9.179E-17	1.091E-16	6.242E-17
1	60	2698	1.636E-17	5.898E-18	3.322E-18	9.775E-19	2.305E-18	1.029E-17
1	60	2710	2.805E-17	3.970E-17	2.750E-17	1.420E-17	1.348E-17	2.611E-17
1	60	2722	9.607E-17	3.372E-16	1.021E-15	2.281E-15	4.187E-15	6.289E-15
1	60	2734	8.811E-15	1.179E-14	1.493E-14	1.942E-14	2.476E-14	3.056E-14
1	60	2746	3.834E-14	4.737E-14	5.672E-14	6.902E-14	8.211E-14	9.714E-14
1	60	2758	1.132E-13	1.304E-13	1.475E-13	1.650E-13	1.802E-13	1.927E-13
1	60	2770	2.012E-13	2.027E-13	1.938E-13	1.727E-13	1.438E-13	1.264E-13
1	60	2782	1.667E-13	2.055E-13	1.785E-13	1.304E-13	1.360E-13	2.220E-13
1	60	2794	3.118E-13	3.833E-13	4.145E-13	3.818E-13	2.787E-13	1.490E-13

1	60	2806	5.008E-14	8.614E-15	4.578E-16	1.848E-16	1.748E-17	3.800E-16
1	60	2818	8.589E-16	1.081E-15	6.000E-16	1.270E-16	3.635E-16	1.028E-15
1	60	2830	1.627E-15	9.689E-16	3.170E-16	3.152E-18	1.890E-18	6.006E-17
1	60	2842	2.031E-16	3.837E-16	3.250E-16	1.720E-16	4.546E-17	2.995E-18
1	60	2854	2.562E-18	4.087E-18	3.527E-18	4.278E-17	1.664E-16	2.983E-16
1	60	2866	2.342E-16	3.832E-16	5.946E-16	6.902E-16	3.803E-16	3.823E-16
1	60	2878	7.939E-16	1.124E-15	6.528E-16	1.830E-16	4.159E-17	1.081E-16
1	60	2890	9.472E-16	2.201E-15	3.214E-15	1.919E-15	6.928E-16	3.316E-16
1	60	2902	6.502E-16	1.418E-15	2.037E-15	1.836E-15	1.262E-15	8.130E-16
1	60	2914	4.925E-16	2.235E-16	1.319E-16	1.478E-16	1.148E-16	6.171E-17
1	60	2926	3.006E-16	9.543E-16	3.676E-15	9.686E-15	1.605E-14	1.522E-14
1	60	2938	8.376E-15	2.114E-15	4.704E-16	9.971E-16	1.598E-15	1.136E-15
1	60	2950	1.442E-15	4.314E-15	8.380E-15	8.026E-15	6.204E-15	6.266E-15
1	60	2962	9.859E-15	1.361E-14	1.912E-14	2.781E-14	4.845E-14	7.889E-14
1	60	2974	1.079E-13	1.267E-13	1.479E-13	1.778E-13	2.183E-13	2.828E-13
1	60	2986	3.622E-13	4.621E-13	5.740E-13	7.207E-13	9.047E-13	1.102E-12
1	60	2998	1.341E-12	1.648E-12	2.025E-12	2.476E-12	2.958E-12	3.539E-12
1	60	3010	4.232E-12	4.954E-12	5.682E-12	6.436E-12	7.179E-12	7.938E-12
1	60	3022	8.686E-12	9.287E-12	9.735E-12	1.003E-11	1.006E-11	9.835E-12
1	60	3034	9.281E-12	8.407E-12	7.176E-12	6.136E-12	6.642E-12	9.582E-12
1	60	3046	1.359E-11	1.676E-11	1.797E-11	1.673E-11	1.245E-11	6.406E-12
1	60	3058	1.966E-12	1.646E-13	9.721E-14	1.914E-13	2.020E-13	1.417E-13
1	60	3070	4.986E-14	1.478E-16	1.020E-14	5.292E-14	1.222E-13	1.553E-13
1	60	3082	1.207E-13	5.829E-14	2.124E-14	8.861E-15	1.063E-14	4.711E-14
1	60	3094	1.143E-13	1.751E-13	1.729E-13	1.960E-13	1.805E-13	1.209E-13
1	60	3106	5.754E-14	4.617E-14	5.412E-14	8.517E-14	1.306E-13	1.830E-13
1	60	3118	1.648E-13	1.519E-13	1.554E-13	1.360E-13	1.174E-13	6.182E-14
1	60	3130	8.154E-14	1.126E-13	1.166E-13	5.953E-14	3.038E-15	6.819E-15
1	60	3142	1.269E-14	1.136E-14	5.411E-15	1.641E-15	3.647E-15	4.679E-15
1	60	3154	2.938E-15	9.796E-16	3.119E-16	5.745E-16	1.370E-15	3.102E-15
1	60	3166	5.808E-15	8.724E-15	8.166E-15	4.929E-15	2.555E-14	7.628E-14
1	60	3178	1.272E-13	8.203E-14	5.565E-14	5.396E-14	5.660E-14	2.903E-14
1	60	3190	2.681E-15	6.579E-15	4.043E-14	9.307E-14	1.172E-13	7.252E-14
1	60	3202	2.374E-14	2.587E-15	2.264E-14	5.879E-14	1.047E-13	1.133E-13
1	60	3214	1.267E-13	1.095E-13	1.076E-13	1.062E-13	7.391E-14	3.633E-14
1	60	3226	3.774E-14	5.598E-14	7.140E-14	6.055E-14	5.752E-14	5.617E-14
1	60	3238	4.540E-14	3.956E-14	6.198E-14	9.582E-14	8.932E-14	4.468E-14
1	60	3250	1.348E-14	3.950E-14	7.765E-14	6.934E-14	5.431E-14	3.749E-14
1	60	3262	2.883E-14	2.675E-14	2.025E-14	1.475E-14	3.445E-14	7.769E-14
1	60	3274	1.228E-13	1.114E-13	6.963E-14	4.438E-14	2.218E-14	1.599E-14
1	60	3286	1.926E-14	3.666E-14	5.470E-14	6.188E-14	4.926E-14	3.538E-14
1	60	3298	2.563E-14	1.590E-14	7.044E-15	7.659E-15	2.747E-14	4.934E-14
1	60	3310	5.738E-14	5.082E-14	3.304E-14	1.832E-14	4.872E-15	6.200E-15
1	60	3322	1.220E-14	1.947E-14	2.130E-14	1.541E-14	8.917E-15	4.898E-15
1	60	3334	1.112E-14	1.806E-14	1.719E-14	1.128E-14	4.909E-15	3.815E-15
1	60	3346	4.325E-15	5.949E-15	7.008E-15	9.003E-15	1.209E-14	1.311E-14
1	60	3358	1.201E-14	1.543E-14	3.434E-14	6.119E-14	7.012E-14	4.477E-14
1	60	3370	1.629E-14	4.193E-15	2.188E-15	3.529E-15	4.616E-15	5.099E-15
1	60	3382	1.225E-14	2.282E-14	2.806E-14	1.700E-14	1.543E-14	2.187E-14
1	60	3394	2.205E-14	1.658E-14	1.064E-14	1.079E-14	1.095E-14	1.077E-14
1	60	3406	1.113E-14	1.240E-14	1.365E-14	1.216E-14	8.434E-15	1.233E-14
1	60	3418	2.508E-14	4.005E-14	3.632E-14	2.177E-14	1.394E-14	1.786E-14
1	60	3430	1.601E-14	1.108E-14	6.101E-15	6.121E-15	1.315E-14	2.272E-14
1	60	3142	2.812E-14	3.925E-14	5.107E-14	4.843E-14	2.600E-14	8.152E-15
1	60	3454	1.155E-14	1.798E-14	2.081E-14	2.804E-14	3.293E-14	2.699E-14

1	60	3466	2.226E-14	2.201E-14	2.217E-14	2.549E-14	2.913E-14	2.231E-14
1	60	3478	1.917E-14	2.943E-14	4.228E-14	3.886E-14	3.782E-14	3.847E-14
1	60	3490	2.384E-14	1.539E-14	1.980E-14	2.746E-14	2.632E-14	4.139E-14
1	60	3502	6.626E-14	7.200E-14	6.112E-14	5.763E-14	7.215E-14	6.159E-14
1	60	3514	3.627E-14	3.819E-14	5.209E-14	7.652E-14	8.970E-14	1.050E-13
1	60	3526	1.350E-13	1.485E-13	1.088E-13	5.526E-14	3.147E-14	3.879E-14
1	60	3538	3.045E-14	3.102E-14	6.424E-14	1.348E-13	1.696E-13	1.515E-13
1	60	3550	1.193E-13	1.154E-13	9.968E-14	7.982E-14	8.298E-14	1.254E-13
1	60	3562	1.832E-13	3.100E-13	4.330E-13	4.392E-13	2.945E-13	1.817E-13
1	60	3574	1.644E-13	1.746E-13	1.709E-13	1.633E-13	1.701E-13	2.724E-13
1	60	3586	4.352E-13	4.888E-13	3.643E-13	1.969E-13	1.298E-13	1.567E-13
1	60	3598	2.079E-13	2.291E-13	2.093E-13	2.007E-13	2.666E-13	3.453E-13
1	60	3610	4.099E-13	4.202E-13	4.153E-13	4.131E-13	4.235E-13	3.898E-13
1	60	3622	2.946E-13	2.182E-13	2.817E-13	4.189E-13	4.586E-13	3.593E-13
1	60	3634	2.676E-13	2.183E-13	2.050E-13	2.006E-13	2.219E-13	2.904E-13
1	60	3646	3.936E-13	4.625E-13	4.168E-13	2.787E-13	1.785E-13	1.462E-13
1	60	3658	1.178E-13	8.812E-14	6.070E-14	6.499E-14	1.112E-13	1.974E-13
1	60	3670	2.481E-13	2.906E-13	3.379E-13	3.641E-13	2.978E-13	2.043E-13
1	60	3682	1.514E-13	1.419E-13	1.767E-13	2.772E-13	3.307E-13	3.012E-13
1	60	3694	2.042E-13	1.302E-13	1.342E-13	1.671E-13	1.985E-13	1.649E-13
1	60	3706	1.568E-13	2.078E-13	2.700E-13	2.747E-13	1.915E-13	1.471E-13
1	60	3718	1.404E-13	1.757E-13	2.220E-13	2.518E-13	2.606E-13	2.210E-13
1	60	3730	2.098E-13	2.920E-13	3.927E-13	4.225E-13	3.594E-13	2.879E-13
1	60	3742	3.400E-13	4.176E-13	3.800E-13	3.220E-13	2.798E-13	2.382E-13
1	60	3754	1.573E-13	1.397E-13	1.386E-13	1.406E-13	1.088E-13	9.573E-14
1	60	3766	1.106E-13	1.128E-13	1.157E-13	7.875E-14	4.976E-14	5.767E-14
1	60	3778	8.783E-14	1.005E-13	8.513E-14	7.057E-14	5.677E-14	3.594E-14
1	60	3790	1.764E-14	1.874E-14	3.933E-14	6.832E-14	8.970E-14	1.066E-13
1	60	3802	1.005E-13	8.412E-14	6.295E-14	4.488E-14	2.298E-14	1.464E-14
1	60	3814	4.296E-14	8.321E-14	1.070E-13	1.316E-13	1.154E-13	7.916E-14
1	60	3826	5.314E-14	5.257E-14	4.875E-14	5.991E-14	6.921E-14	8.005E-14
1	60	3838	1.057E-13	1.129E-13	9.980E-14	7.641E-14	4.098E-14	3.533E-14
1	60	3850	6.826E-14	1.257E-13	1.629E-13	1.185E-13	7.071E-14	4.746E-14
1	60	3862	7.231E-14	8.440E-14	8.009E-14	7.371E-14	7.633E-14	6.484E-14
1	60	3874	4.734E-14	3.425E-14	5.045E-14	7.805E-14	7.975E-14	7.371E-14
1	60	3886	6.323E-14	4.544E-14	3.878E-14	4.001E-14	3.124E-14	2.908E-14
1	60	3898	5.247E-14	8.457E-14	1.041E-13	8.996E-14	5.864E-14	2.357E-14
1	60	3910	4.276E-15	1.756E-15	1.483E-14	3.208E-14	3.859E-14	3.190E-14
1	60	3922	2.250E-14	2.451E-14	2.466E-14	2.401E-14	2.686E-14	2.980E-14
1	60	3934	2.032E-14	1.024E-14	4.606E-15	8.780E-15	1.425E-14	1.456E-14
1	60	3946	1.312E-14	1.348E-14	1.613E-14	1.210E-14	8.150E-15	4.557E-15
1	60	3958	2.992E-15	3.286E-15	3.351E-15	2.201E-15	1.396E-15	1.538E-15
1	60	3970	3.093E-15	4.896E-15	4.996E-15	3.198E-15	1.180E-15	8.254E-16
1	60	3982	1.001E-15	8.162E-16	4.411E-16	4.187E-16	7.512E-16	8.175E-16
1	60	3994	6.763E-16	4.414E-16	2.773E-16	1.250E-16	1.219E-16	3.080E-16
1	60	4006	1.192E-15	2.117E-15	2.029E-15	1.444E-15	6.709E-16	9.376E-16
1	60	4018	1.385E-15	1.614E-15	1.409E-15	1.357E-15	1.517E-15	9.935E-16
1	60	4030	4.444E-16	2.041E-16	7.669E-17	1.804E-17	8.934E-18	1.085E-16
1	60	4042	8.520E-16	1.573E-15	1.392E-15	6.542E-16	1.514E-17	1.394E-17
1	60	4054	8.553E-18	4.452E-17	2.073E-16	3.699E-16	2.918E-16	1.271E-16
1	60	4066	2.306E-18	3.413E-18	4.571E-17	1.159E-16	1.729E-16	1.571E-16
1	60	4078	2.029E-16	2.559E-16	2.416E-16	2.448E-16	3.476E-16	3.935E-16
1	60	4090	2.183E-16	6.854E-17	2.572E-18	1.314E-18	1.749E-19	9.657E-18
1	60	4102	1.573E-16	4.025E-16	5.811E-16	3.648E-16	1.388E-16	2.351E-17
1	60	4114	5.956E-18	5.887E-19	9.363E-18	2.228E-17	2.969E-17	2.053E-17

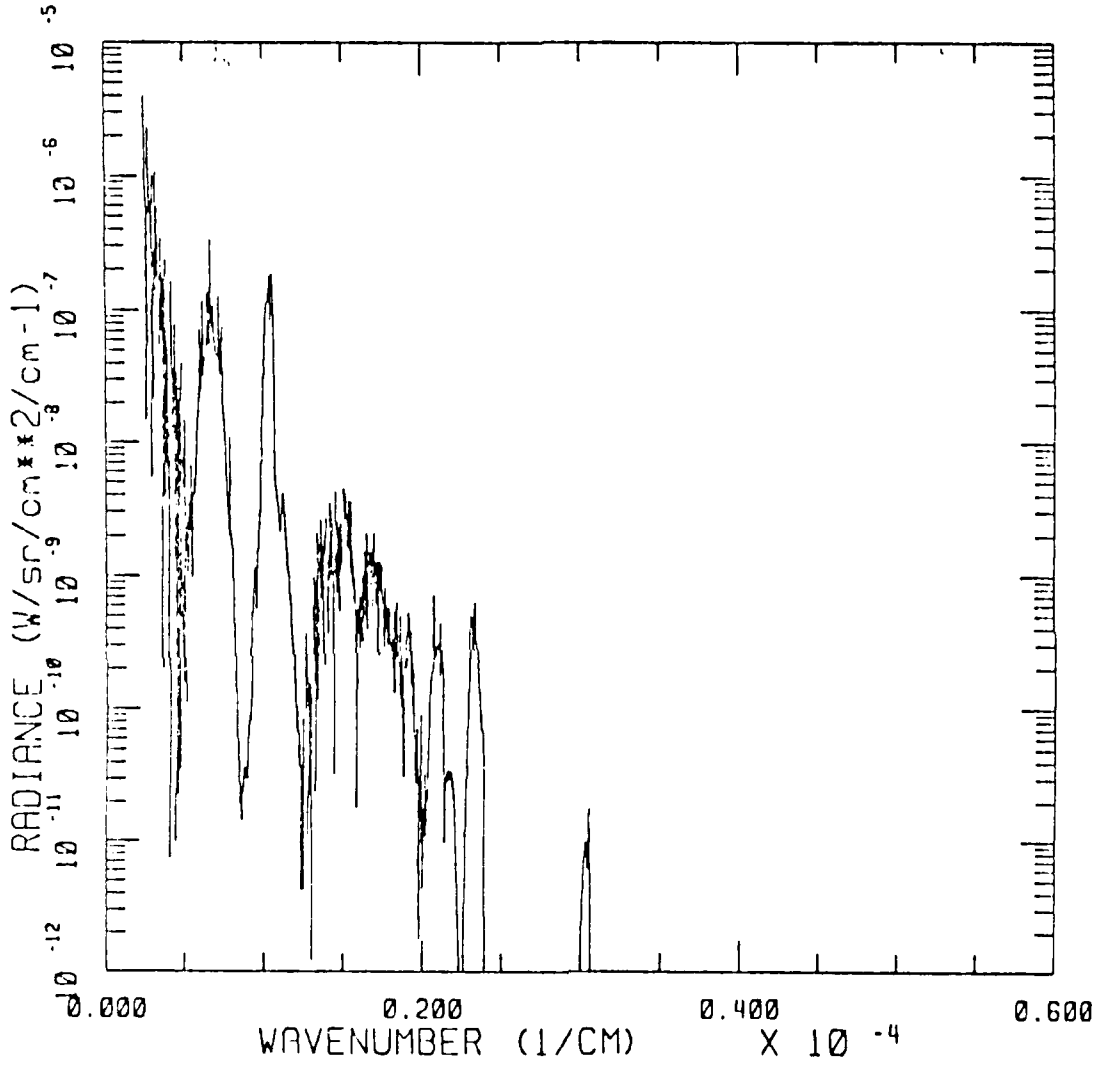
1	60	4126	6.968E-18	3.097E-18	2.755E-17	7.779E-17	1.188E-16	1.238E-16
1	60	4138	1.242E-16	1.088E-16	8.317E-17	4.076E-17	4.252E-17	4.961E-17
1	60	4150	6.090E-17	6.740E-17	7.474E-17	7.464E-17	7.685E-17	7.809E-17
1	60	4162	8.633E-17	9.744E-17	1.139E-16	1.272E-16	1.475E-16	1.661E-16
1	60	4174	1.801E-16	1.943E-16	2.208E-16	2.532E-16	2.881E-16	3.136E-16
1	60	4186	3.469E-16	3.848E-16	4.200E-16	4.707E-16	5.141E-16	5.673E-16
1	60	4198	6.055E-16	6.764E-16	7.172E-16	7.722E-16	8.449E-16	8.879E-16
1	60	4210	9.578E-16	1.002E-15	1.141E-15	1.124E-15	1.175E-15	1.229E-15
1	60	4222	1.258E-15	1.312E-15	1.331E-15	1.367E-15	1.369E-15	1.465E-15
1	60	4234	1.364E-15	1.510E-15	1.308E-15	1.410E-15	1.193E-15	1.240E-15
1	60	4246	1.018E-15	1.018E-15	7.869E-16	7.391E-16	5.012E-16	3.977E-16
1	60	4258	1.751E-16	1.292E-16	1.713E-16	4.142E-16	5.150E-16	7.933E-16
1	60	4270	8.869E-16	1.104E-15	1.283E-15	1.315E-15	1.651E-15	1.461E-15
1	60	4282	1.810E-15	1.727E-15	1.743E-15	1.927E-15	1.647E-15	1.821E-15
1	60	4294	1.732E-15	1.558E-15	1.628E-15	1.437E-15	1.307E-15	1.259E-15
1	60	4306	1.100E-15	9.643E-16	8.654E-16	7.642E-16	6.183E-16	5.271E-16
1	60	4318	4.373E-16	3.526E-16	2.804E-16	2.182E-16	1.657E-16	1.227E-16
1	60	4330	8.820E-17	6.170E-17	4.204E-17	2.783E-17	1.775E-17	9.879E-18
1	60	4342	4.018E-18	9.840E-19	2.632E-20	9.120E-21	6.946E-21	1.616E-20
1	60	4354	5.612E-20	9.743E-20	7.864E-20	5.988E-20	5.582E-20	5.903E-20
1	60	4366	3.491E-20	9.673E-21	7.396E-21	7.431E-21	8.955E-21	1.600E-20
1	60	4378	1.826E-20	1.837E-20	9.110E-21	2.619E-21	3.897E-21	8.484E-21
1	60	4390	9.712E-21	5.348E-21	1.159E-21	4.187E-22	1.002E-21	1.320E-21
1	60	4402	8.971E-22	4.124E-21	9.608E-21	1.337E-20	1.066E-20	5.975E-21
1	60	4414	3.607E-21	2.831E-21	3.326E-21	2.957E-21	2.516E-21	1.472E-21
1	60	4426	8.429E-22	1.109E-21	1.592E-21	4.537E-21	7.097E-21	6.854E-21
1	60	4438	3.536E-21	2.285E-22	0.000E+00	4.358E-22	2.796E-21	5.229E-21
1	60	4450	5.753E-21	4.154E-21	3.325E-21	2.534E-21	1.554E-21	5.622E-22
1	60	4462	1.226E-22	3.017E-22	9.459E-22	1.424E-21	1.205E-21	6.173E-22
1	60	4474	9.186E-23	5.703E-24	0.000E+00	0.000E+00	0.000E+00	0.000E+00
1	60	4486	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
1	60	4498	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
1	60	4510	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
1	60	4522	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
1	60	4534	0.000E+00	0.000E+00	0.000E+00	2.181E-23	1.196E-22	2.175E-22
1	60	4546	1.739E-22	7.603E-23	0.000E+00	0.000E+00	0.000E+00	0.000E+00
1	60	4558	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
1	60	4570	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.572E-24	3.610E-23
1	60	4582	6.762E-23	5.848E-23	2.695E-23	0.000E+00	0.000E+00	0.000E+00
1	60	4594	0.000E+00	0.000E+00	1.662E-24	2.731E-23	6.043E-23	7.113E-23
1	60	4606	7.024E-23	7.772E-23	8.548E-23	4.655E-23	1.261E-23	4.250E-23
1	60	4618	8.523E-23	8.524E-23	5.064E-23	1.140E-23	1.160E-23	1.703E-23
1	60	4630	6.562E-23	1.154E-22	1.227E-22	6.492E-23	5.282E-23	9.159E-23
1	60	4642	9.195E-23	5.442E-23	3.101E-23	7.018E-23	1.147E-22	1.487E-22
1	60	4654	1.056E-22	4.435E-23	1.094E-23	2.521E-23	3.708E-23	6.133E-23
1	60	4666	2.103E-22	3.954E-22	3.825E-22	2.563E-22	1.924E-22	2.619E-22
1	60	4678	2.843E-22	2.444E-22	1.958E-22	1.864E-22	3.981E-22	6.313E-22
1	60	4690	5.075E-22	2.368E-22	1.128E-22	1.631E-22	2.383E-22	3.158E-22
1	60	4702	3.656E-22	2.892E-22	2.191E-22	1.718E-22	1.203E-22	7.785E-23
1	60	4714	9.282E-23	1.512E-22	2.717E-22	3.889E-22	4.261E-22	4.631E-22
1	60	4726	6.548E-22	7.503E-22	1.117E-21	1.594E-21	1.694E-21	1.073E-21
1	60	4738	3.155E-22	2.188E-22	2.997E-22	5.095E-22	6.092E-22	5.444E-22
1	60	4750	4.332E-22	3.204E-22	2.839E-22	2.152E-22	5.647E-22	1.157E-21
1	60	4762	1.608E-21	1.211E-21	6.167E-22	3.351E-22	3.994E-22	9.182E-22
1	60	4774	1.316E-21	1.456E-21	1.201E-21	8.961E-22	5.687E-22	1.251E-21

1	60	4786	2.918E-21	4.409E-21	2.669E-21	1.340E-21	1.461E-21	2.573E-21
1	60	4798	2.680E-21	4.052E-21	6.688E-21	9.573E-21	1.015E-20	1.175E-20
1	60	4810	1.705E-20	2.700E-20	3.942E-20	5.301E-20	7.035E-20	9.386E-20
1	60	4822	1.242E-19	1.599E-19	1.980E-19	2.346E-19	2.703E-19	3.045E-19
1	60	4834	3.268E-19	3.480E-19	3.634E-19	3.730E-19	3.752E-19	3.741E-19
1	60	4846	3.594E-19	3.247E-19	2.588E-19	1.867E-19	1.577E-19	2.241E-19
1	60	4858	3.036E-19	3.629E-19	3.941E-19	3.922E-19	4.053E-19	3.952E-19
1	60	4870	3.757E-19	3.492E-19	3.078E-19	2.632E-19	2.060E-19	1.517E-19
1	60	4882	1.017E-19	6.338E-20	3.613E-20	2.341E-20	2.531E-20	3.087E-20
1	60	4894	2.433E-20	1.247E-20	2.133E-20	4.413E-20	5.940E-20	3.891E-20
1	60	4906	1.854E-20	7.310E-21	3.257E-21	2.324E-21	1.236E-20	3.587E-20
1	60	4918	5.953E-20	5.147E-20	4.568E-20	5.112E-20	7.018E-20	9.649E-20
1	60	4930	1.241E-19	1.460E-19	1.701E-19	2.156E-19	2.826E-19	3.696E-19
1	60	4942	4.538E-19	5.096E-19	5.599E-19	6.117E-19	6.567E-19	7.052E-19
1	60	4954	7.699E-19	8.432E-19	8.972E-19	8.808E-19	8.774E-19	8.857E-19
1	60	4966	9.045E-19	8.937E-19	8.633E-19	8.215E-19	7.309E-19	6.179E-19
1	60	4978	5.578E-19	7.007E-19	8.852E-19	1.028E-18	1.154E-18	1.188E-18
1	60	4990	1.245E-18	1.253E-18	1.221E-18	1.130E-18	9.925E-19	8.979E-19
1	60	5002	8.220E-19	7.255E-19	5.305E-19	3.509E-19	1.943E-19	1.526E-19
1	60	5014	1.362E-19	8.691E-20	3.984E-20	4.086E-20	1.501E-19	2.461E-19
1	60	5026	2.074E-19	1.268E-19	1.980E-19	3.388E-19	2.937E-19	1.667E-19
1	60	5038	5.890E-20	7.213E-20	8.618E-20	7.721E-20	1.617E-19	3.970E-19
1	60	5050	5.812E-19	4.468E-19	1.875E-19	3.926E-20	6.113E-20	9.545E-20
1	60	5062	1.648E-19	2.225E-19	2.573E-19	3.405E-19	5.379E-19	6.902E-19
1	60	5074	5.494E-19	3.418E-19	2.820E-19	3.342E-19	3.635E-19	3.590E-19
1	60	5086	3.816E-19	4.793E-19	7.187E-19	9.788E-19	1.162E-18	1.202E-18
1	60	5098	1.052E-18	1.056E-18	1.071E-18	1.276E-18	1.161E-18	1.028E-18
1	60	5110	9.981E-19	1.025E-18	1.101E-18	1.425E-18	1.779E-18	1.859E-18
1	60	5122	1.173E-18	6.020E-19	5.415E-19	6.168E-19	1.015E-18	1.473E-18
1	60	5134	1.574E-18	1.280E-18	1.491E-18	2.625E-18	3.891E-18	2.785E-18
1	60	5146	1.454E-18	1.322E-18	1.996E-18	3.023E-18	4.826E-18	6.514E-18
1	60	5158	5.914E-18	5.815E-18	6.087E-18	7.237E-18	4.619E-18	3.937E-18
1	60	5170	5.267E-18	4.777E-18	3.666E-18	3.368E-18	4.463E-18	4.852E-18
1	60	5182	8.266E-18	1.188E-17	1.304E-17	1.062E-17	5.954E-18	3.650E-18
1	60	5194	5.494E-18	1.016E-17	1.021E-17	5.254E-18	6.179E-18	2.005E-17
1	60	5206	3.847E-17	3.544E-17	2.045E-17	5.866E-18	1.275E-18	4.914E-18
1	60	5218	8.039E-18	7.966E-18	1.372E-17	2.176E-17	2.570E-17	1.904E-17
1	60	5230	1.407E-17	1.319E-17	1.065E-17	4.841E-18	2.775E-18	4.776E-18
1	60	5242	1.328E-17	2.676E-17	3.188E-17	3.220E-17	1.951E-17	1.635E-17
1	60	5254	1.831E-17	1.620E-17	1.169E-17	1.367E-17	2.557E-17	3.114E-17
1	60	5266	2.348E-17	1.542E-17	9.526E-18	4.490E-18	7.220E-19	1.751E-18
1	60	5278	4.719E-18	8.087E-18	9.685E-18	1.065E-17	1.025E-17	1.269E-17
1	60	5290	1.574E-17	1.102E-17	4.359E-18	1.390E-18	3.469E-18	5.688E-18
1	60	5302	4.205E-18	6.526E-18	1.076E-17	1.282E-17	7.199E-18	2.312E-18
1	60	5314	2.719E-18	4.182E-18	3.086E-18	1.701E-18	1.091E-18	6.488E-18
1	60	5326	1.245E-17	1.608E-17	1.318E-17	1.161E-17	1.308E-17	2.294E-17
1	60	5338	2.827E-17	2.353E-17	2.357E-17	2.668E-17	2.565E-17	1.784E-17
1	60	5350	1.373E-17	1.951E-17	2.085E-17	1.297E-17	3.943E-18	1.483E-18
1	60	5362	3.625E-18	5.399E-18	3.747E-18	1.763E-18	1.404E-18	3.956E-18
1	60	5374	1.187E-17	1.540E-17	1.236E-17	5.897E-18	4.222E-18	9.146E-18
1	60	5386	1.197E-17	6.737E-18	5.214E-18	8.658E-18	1.450E-17	1.256E-17
1	60	5398	6.609E-18	2.783E-18	1.522E-18	2.382E-18	4.265E-18	1.003E-17
1	60	5410	1.750E-17	2.010E-17	1.823E-17	8.618E-18	2.801E-18	4.251E-19
1	60	5422	6.718E-19	1.879E-18	6.409E-18	1.135E-17	1.200E-17	1.043E-17
1	60	5434	9.363E-18	7.795E-18	7.437E-18	8.386E-18	1.199E-17	1.146E-17

1	60	5446	1.116E-17	9.086E-18	6.171E-18	3.258E-18	2.174E-18	3.197E-18
1	60	5458	4.769E-18	6.456E-18	6.175E-18	5.914E-18	4.378E-18	4.489E-18
1	60	5470	2.966E-18	3.744E-18	6.019E-18	7.046E-18	3.915E-18	7.788E-19
1	60	5482	2.138E-19	7.458E-19	2.059E-18	3.335E-18	4.769E-18	5.481E-18
1	60	5494	4.471E-18	2.538E-18	1.032E-18	9.143E-19	7.943E-19	1.132E-18
1	60	5506	1.800E-18	2.071E-18	1.241E-18	5.778E-19	6.937E-19	1.123E-18
1	60	5518	1.086E-18	9.700E-19	8.794E-19	5.992E-19	2.867E-19	1.931E-19
1	60	5530	2.041E-19	3.053E-19	4.971E-19	6.811E-19	5.048E-19	2.524E-19
1	60	5542	1.022E-19	1.550E-19	2.459E-19	3.535E-19	4.250E-19	4.940E-19
1	60	5554	4.296E-19	2.676E-19	1.189E-19	5.834E-20	7.528E-20	8.995E-20
1	60	5566	8.410E-20	7.601E-20	6.352E-20	6.946E-20	9.066E-20	9.371E-20
1	60	5578	6.966E-20	4.211E-20	3.845E-20	3.757E-20	2.433E-20	1.259E-20
1	60	5590	8.411E-21	1.297E-20	2.031E-20	2.939E-20	3.015E-20	6.100E-20
1	60	5602	9.161E-20	8.050E-20	4.032E-20	3.326E-21	1.206E-20	3.215E-20
1	60	5614	5.095E-20	3.081E-20	2.241E-20	3.096E-20	4.298E-20	2.582E-20
1	60	5626	1.249E-20	1.474E-20	2.226E-20	1.558E-20	1.311E-20	1.447E-20
1	60	5638	1.158E-20	5.120E-21	4.634E-22	3.059E-21	6.679E-21	8.783E-21
1	60	5650	6.122E-21	2.540E-21	1.226E-21	7.211E-22	3.092E-21	2.243E-20
1	60	5662	4.254E-20	3.890E-20	1.860E-20	1.760E-21	3.030E-21	5.190E-21
1	60	5674	4.449E-21	4.006E-21	4.485E-21	3.248E-21	1.386E-21	1.535E-23
1	60	5686	1.222E-21	4.636E-21	9.162E-21	8.792E-21	6.559E-21	5.945E-21
1	60	5698	6.092E-21	3.369E-21	7.859E-22	2.820E-22	3.025E-21	5.988E-21
1	60	5710	6.644E-21	3.558E-21	4.779E-22	9.846E-23	2.489E-22	2.219E-21
1	60	5722	7.744E-21	1.177E-20	8.997E-21	3.925E-21	1.626E-21	2.895E-21
1	60	5734	2.233E-21	9.636E-22	3.353E-22	2.378E-21	4.280E-21	4.193E-21
1	60	5746	2.736E-21	1.390E-21	8.149E-22	2.501E-22	3.702E-22	1.089E-21
1	60	5758	2.153E-21	2.359E-21	1.639E-21	6.730E-22	1.256E-22	3.495E-22
1	60	5770	1.808E-21	3.448E-21	3.144E-21	1.497E-21	1.803E-22	1.151E-22
1	60	5782	4.104E-22	7.165E-22	5.211E-22	2.216E-22	1.273E-22	2.121E-22
1	60	5794	3.111E-22	5.729E-22	9.972E-22	1.222E-21	1.145E-21	5.225E-22
1	60	5806	6.735E-22	1.182E-21	1.496E-21	8.367E-22	1.762E-22	1.347E-23
1	60	5818	6.600E-24	4.536E-24	3.807E-24	1.753E-22	3.541E-22	4.055E-22
1	60	5830	5.321E-22	7.123E-22	7.345E-22	3.958E-22	7.076E-23	1.010E-23
1	60	5842	2.263E-23	4.965E-23	6.861E-23	1.077E-22	3.143E-22	5.539E-22
1	60	5854	4.700E-22	3.024E-22	1.446E-22	1.209E-22	7.739E-23	3.670E-23
1	60	5866	1.915E-23	3.303E-23	4.948E-23	3.171E-23	1.390E-23	6.738E-23
1	60	5878	1.368E-22	1.529E-22	1.055E-22	5.211E-23	2.748E-23	4.380E-23
1	60	5890	1.356E-22	2.379E-22	1.994E-22	8.819E-23	1.571E-23	1.052E-23
1	60	5902	1.722E-23	1.392E-23	1.160E-23	2.741E-23	6.111E-23	1.233E-22
1	60	5914	1.413E-22	1.117E-22	5.431E-23	1.212E-23	5.432E-24	6.354E-24
1	60	5926	1.117E-23	1.280E-23	7.599E-24	2.937E-24	1.001E-23	2.687E-23
1	60	5938	4.282E-23	2.858E-23	1.067E-23	1.093E-24	2.923E-25	1.268E-24
1	60	5950	4.926E-24	8.685E-24	9.702E-24	1.123E-23	1.536E-23	1.612E-23
1	60	5962	1.553E-23	1.393E-23	1.405E-23	1.418E-23	1.111E-23	8.983E-24
1	60	5974	8.565E-24	6.359E-24	3.563E-24	2.963E-24	3.849E-24	2.840E-24
1	60	5986	1.987E-24	3.184E-24	6.932E-24	8.992E-24	6.111E-24	2.321E-24
1	60	5998	1.121E-26	2.299E-27				

Tue Nov 17 14:31:40 1987

TEST CASE NUMBER 1



HAIRM JANUARY 1985 RELEASE ALT. 60 KM.

Tue Nov 17 14:31:40 1987

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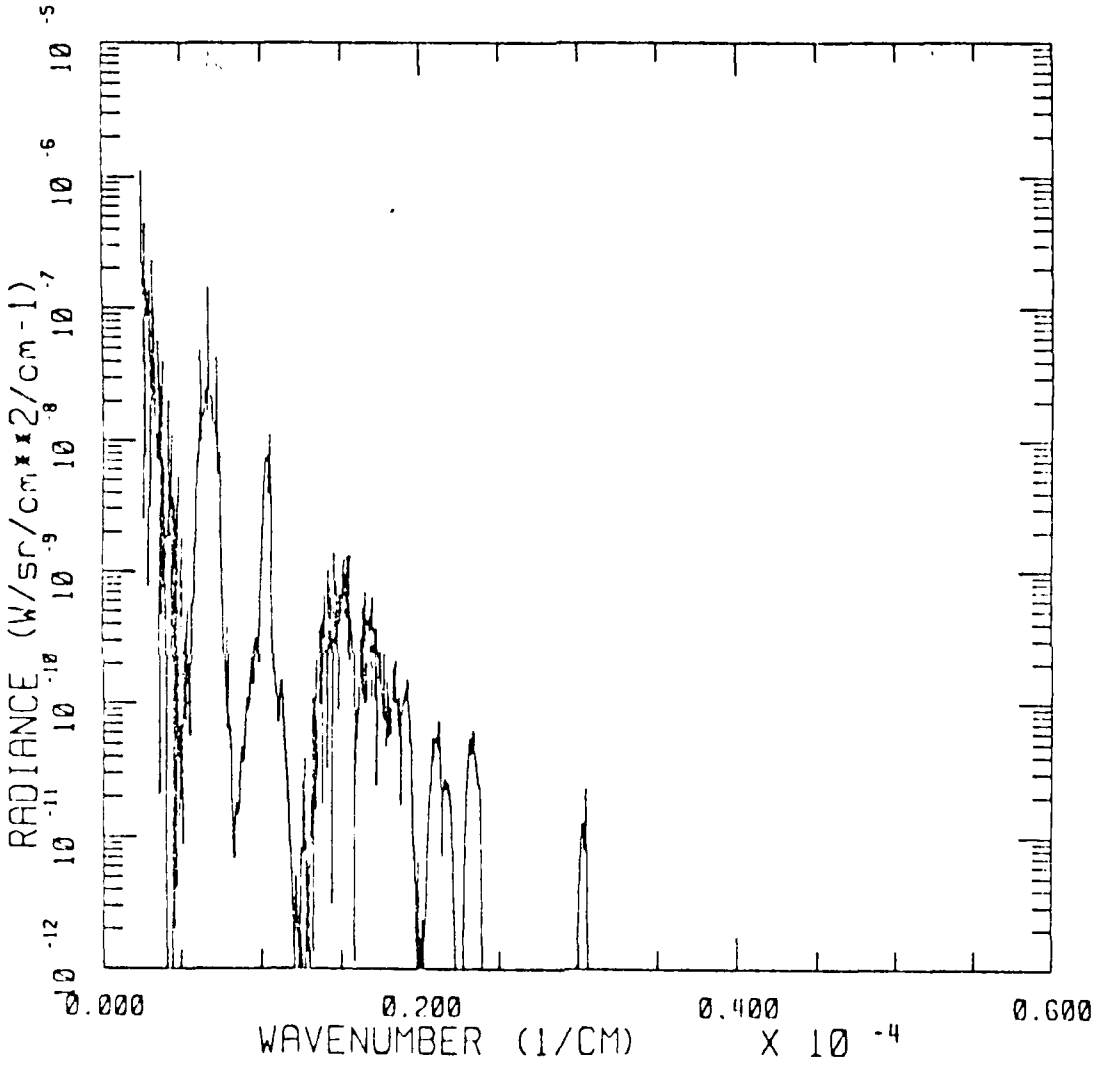

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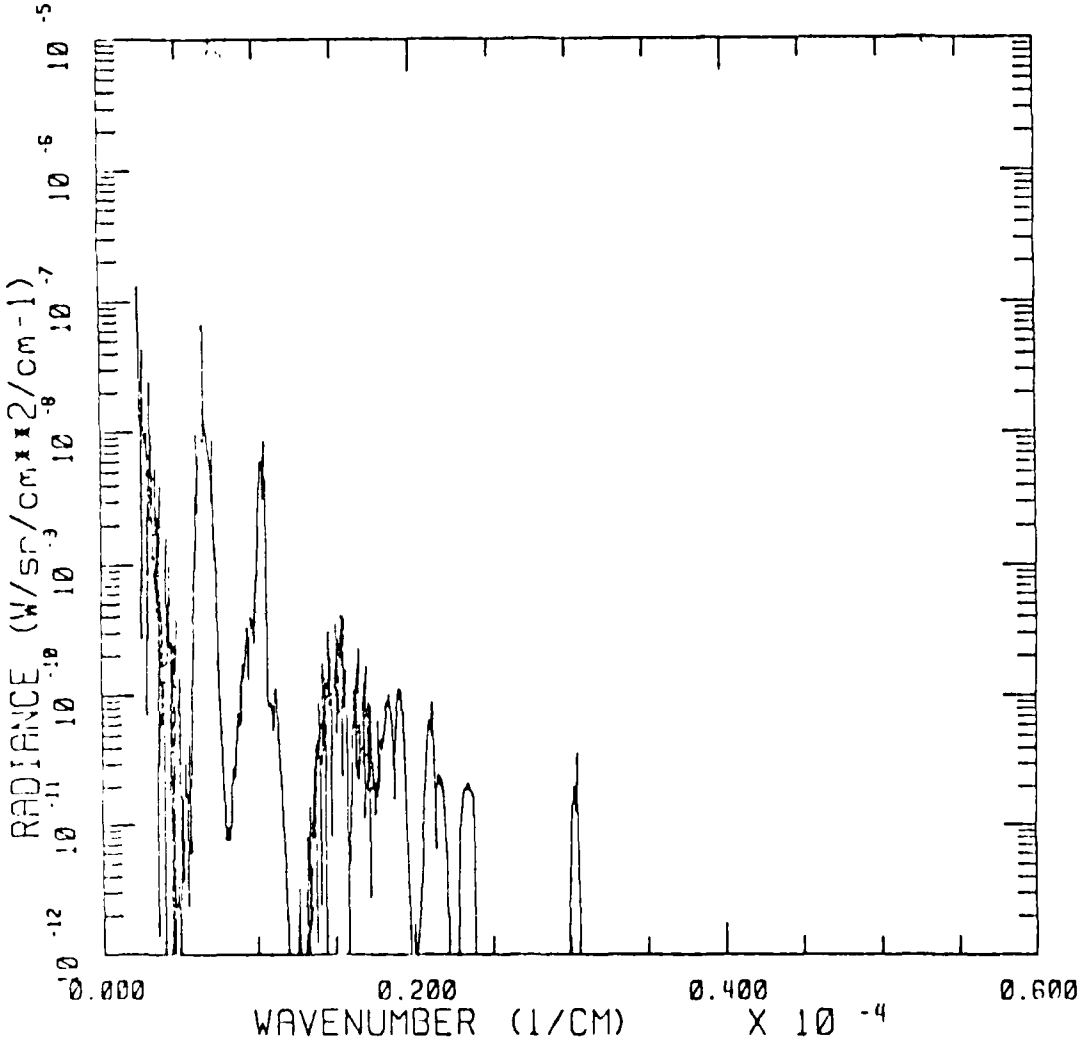

HAIRM JANUARY 1985 RELEASE ALT. 80 KM.

Tue Nov 17 14:31:40 1987

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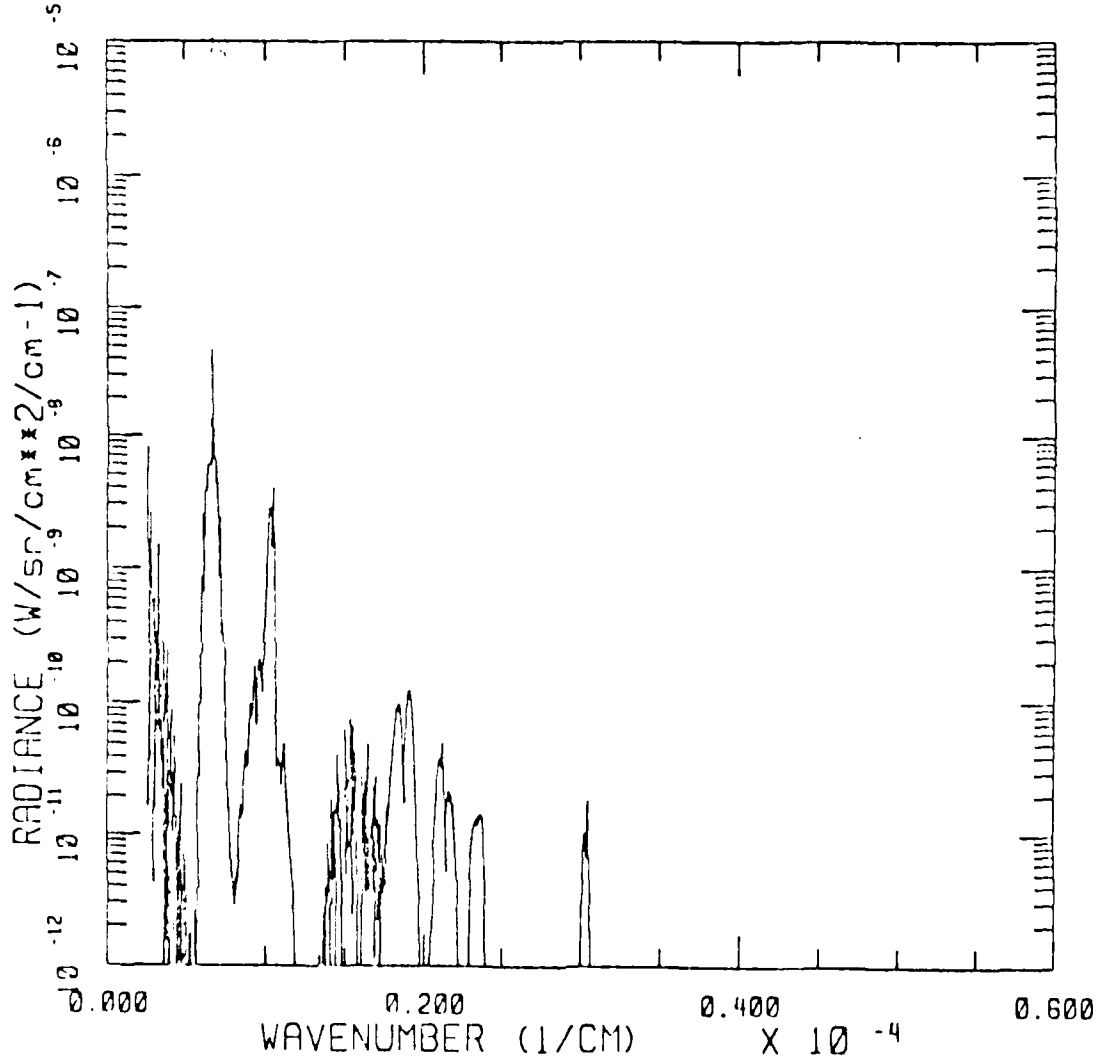

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Tue Nov 17 14:31:40 1987

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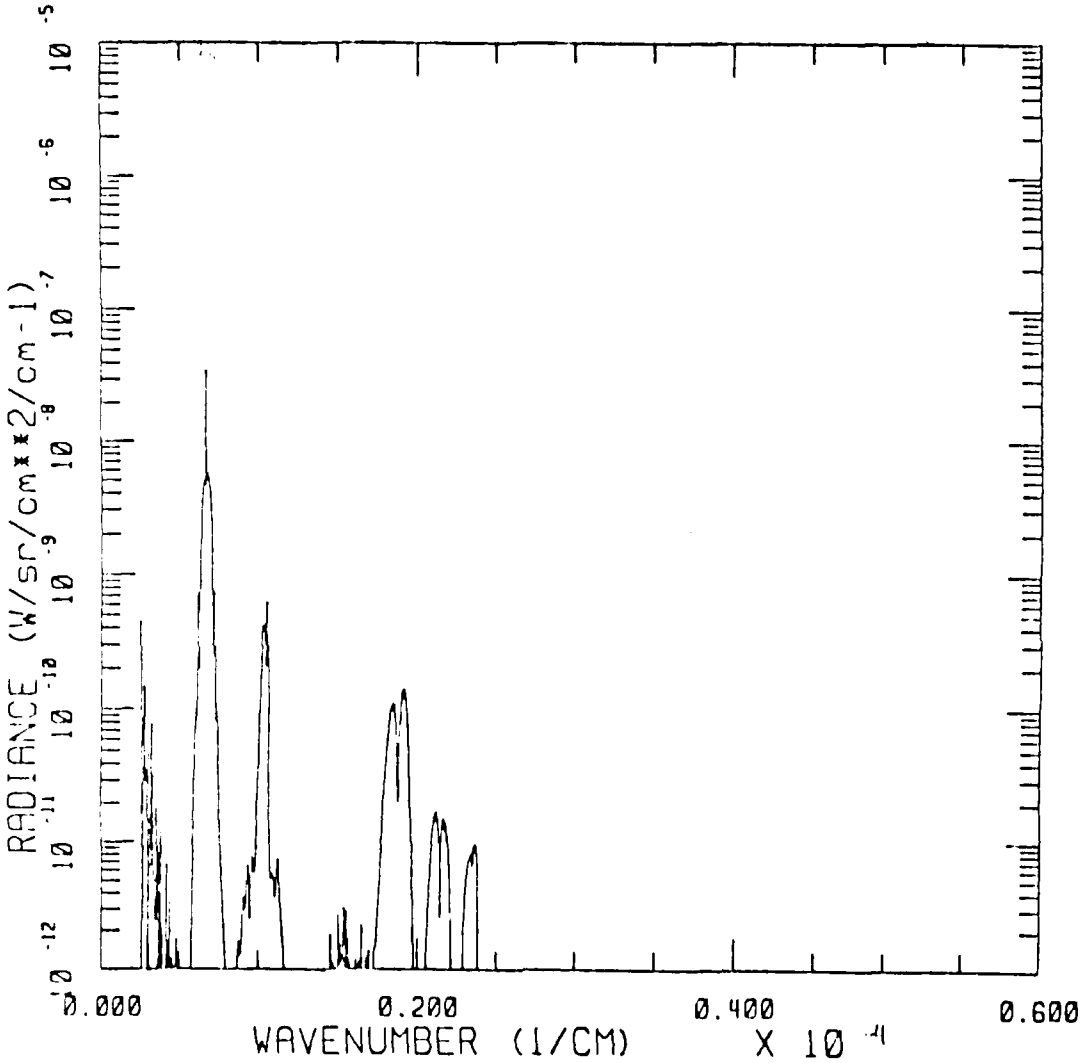
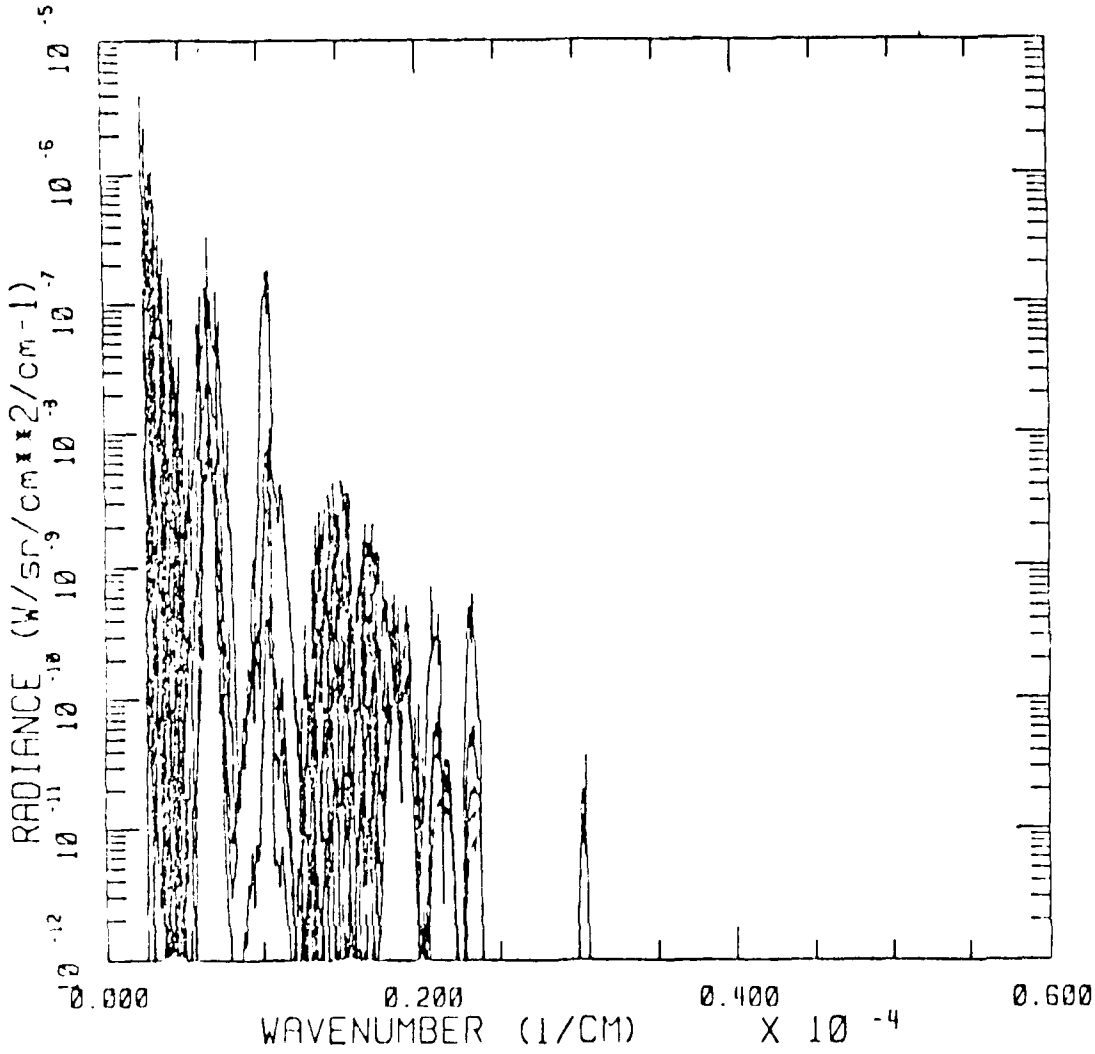


HAIRM JANUARY 1985 RELEASE ALT. 100KM.

Tue Nov 17 14:31:40 1987

TEST CASE NUMBER 1



HAIRM JANUARY 1985 RELEASE ALT. KM.

(Combination Plot with the Previous Five Curves)

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                ** ** ** ** ** **   DEFLTS.2    ** ** ** ** ** **
C0 FILE DEFLTS        TEST CASE NUMBER 2
C0 THIS FILE HOLDS THE VALUES THAT THE INPUT PARAMETERS OF
C0 HAIRM  WILL DEFAULT TO.
C0 THIS FILE IS UPDATED TO THE CURRENT VALUES OF THE PARAMETERS
C0 EACH TIME HAIRM IS RUN.
C0
C1 THE FIRST LINE CONTAINS THE INTERACTIVE/BATCH OPTION
C1 IF IT EQUALS 1, HAIRM WILL RUN INTERACTIVELY, ALLOWING
C1 THE USER TO UPDATE OPTIONS.  IF IT EQUALS 0, HAIRM WILL
C1 RUN WITHOUT STOPPING TO ALLOW THE USER TO UPDATE DEFLTS.
C1 FORMAT = I4
C1##
   1
C2 THE SECOND LINE CONTAINS THE VARIABLE IATMOS.
C2 THIS VARIABLE IS USED TO SELECT THE DESIRED MODEL ATMOSPHERE AND
C2 THE ATMOSPHERIC FILE NAME.
C2 FORMAT = I4,2X,A11
C2##  ############
   7  ATM45WN.DAT
C3 THE THIRD LINE CONTAINS THE EXO-ATMOSPHERIC TEMPERATURE AND
C3 A CONTROL PARAMETER WHICH SELECTS EITHER THE DAY(4) OR NIGHT(3)
C3 OPTION FOR THE MODEL ATMOSPHERE.  THE LAST VARIABLE CONTROLS THE
C3 CONDITION OF THE CALCULATION. (NLTE ,LTE ,ETC.)
C3 FORMAT = E12.5,2X,I4,2X,I4
C3.#####E+##  ####  ####
  .15000E+04     4     4
C4 THE FOURTH LINE CONTAINS THE SOLAR ZENITH ANGLE.
C4 FORMAT = E12.5
C4.#####E+##
  .60000E+02
C5 THE FIFTH LINE CONTAINS THE INPUT FOR THE NUMBER OF
C5 ALTITUDES FOR WHICH SPECTRA WILL BE CALCULATED; MAXIMUM OF ELEVEN.
C5 FORMAT = I4
C5##
   2
C6 THE SIXTH LINE CONTAINS THE FIRST FIVE ALTITUDES (KM) FOR SPCTRA
C6 FORMAT = 5(2x,E10.4)
C6 .####E+##    ####E+##    .####E+##    .####E+##    .####E+##
   .6000E+02   .6200E+02   .0000E+00   .0000E+00   .0000E+00
C7 THE SEVENTH LINE CONTAINS THE LAST SIX ALTITUDES (KM) FOR SPCTRA
C7 FORMAT = 6(2x,E10.4)
C7 .####E+##   .####E+##   .####E+##   .####E+##   .####E+##   .####E+##
   .1500E+03   .1200E+03   .1300E+03   .1400E+03   .1500E+03   .1600E+03
C8 THE EIGHTH LINE CONTAINS A SWITCH FOR CHOOSING 1=LIMB, 2=VERTICAL,
C8 OR 3=HORIZONTAL VIEWING LEVEL FOR EACH ALTITUDE OF INTEREST.
C8 FORMAT = 5(I6,6X)
C8####      ######      ######      ######      ######
     3           3           1           1           1
C9 THE FIRST PARAMETER ENALBES PLOTTING MODE ONLY EXECUTION
C9 WHEN IT IS SET TO 0.
C9 THE SECOND PARAMETER IS THE NUMBER OF PLOTS.
C9 THE NAME OF THE FILE TO BE PLOTTED IS ALSO
C9 INCLUDED (NECESSARY WHEN IPLOT = 0).
C9 FORMAT = 2(I4),2x,A40
C9## ###  ########################################
   0    2  'NPEN
```

```
C10THIS LINE CONTAINS THE FIRST FIVE ALTITUDES(KM) FOR PLOTTING.
C10FORMAT = 5(2x,E10.4)
C10.####E+##    .####E+##    .####E+##    .####E+##    .####E+##
   .6000E+02    .6200E+02    .8000E+02    .9000E+02    .1000E+03
C11THIS LINE CONTAINS THE REMAINING ALTITUDES(KM) FOR PLOTTING.
C11FORMAT = 6(2x,E10.4)
C11.####E+##    .####E+##    .####E+##    .####E+##    .####E+##    .####E+##
   .1100E+03    .1200E+03    .1300E+03    .1400E+03    .1500E+03    .1600E+03
C12 THIS LINE CONTAINS A TITLE AND NUMBER OF CHARACTERS IN THE TITLE
C12FORMAT = (A50,2X,I4)
C12################################################  ####
WAVENUMBER (1/CM)                                     17
C13 THIS LINE CONTAINS LENGTH OF ABSCISSA IN INCHES.
C13 THE WAVENUMBER MIN AND MAX.
C13 THE OFFSET BETWEEN THE ABSCISSA AXIS AND PLOT BEGINNING
C13 FORMAT = 5(E10.3,2X),I4
C13###E+##     .###E+##     .###E+##     .###E+##     .###E+##  ####
  .500E+01     .250E+03     .600E+04     .000E+00     .000E+00     0
C14 THIS LINE CONTAINS A TITLE AND NUMBER OF CHARACTERS IN FILE
C14FORMAT = (A50,2X,I4)
C14################################################  ####
RADIANCE (W/sr/cm**2/micron)                          28
C15 THIS LINE CONTAINS LENGTH OF ORDINATE IN INCHES.
C15 THREE PARAMETERS WHICH DETERMINE LOG OR LINEAR SCALE
C15 FORMAT= E10.3,2X,2(I4,2X)
C15###E+##  ####  ####  ####
  .500E+01     0     0     0
C16 THIS LINE CONTAINS A TITLE.
C16 ALSO A SCALING FACTOR AND A FILE CONTROL PARAMETER WHICH PLOTS
C16 ONLY THE LAST SUMMARY PLOT IF THE VARIABLE IS NON-ZERO.
C16 FORMAT = (A50,2X,E10.3,2X,I4)
C14################################################  .###E+##  ####
   TEST CASE NUMBER 2                               1.00    0
C17 THIS LINE CONTAINS THE 11 VIEWING NUMBERS: 1=LIMB,2=VERTICAL,
C17 3=HORIZONATAL FOR PLOTTING PROGRAM
C17 11(I4,2X)
C17#  ####  ####  ####  ####  ####  ####  ####  ####  ####  ####
   3     3     1     1     1     1     1     1     1     1     1
C18THIS LINE CONTAINS THE OUTPUT CONTROL PARAMTERS. A 1 MEANS THE OUTPUT
C18WILL BE SAVED TO A FILE AND A 0 MEANS THE OUTPUT WILL NOT BE SAVED.
C18 THE FILES ARE 1. OPTICAL THICKNESS FILE
C18               2. BGND2, BGND3, BGND4, BGND6, AND BGND7 OUTPUT
C18               3. ATMOSPHERIC COOLING RATES
C18               4. BGND9 OUTPUTS (RUNS FIVE TIMES)
C18               5. SPCTRA OUTPUT
C18               6. TRYPEN OUTPUT
C18 FORMAT = 6(2X,I4)
C18###  ####  ####  ####  ####  ####
     1     1     1     1     1     1
```

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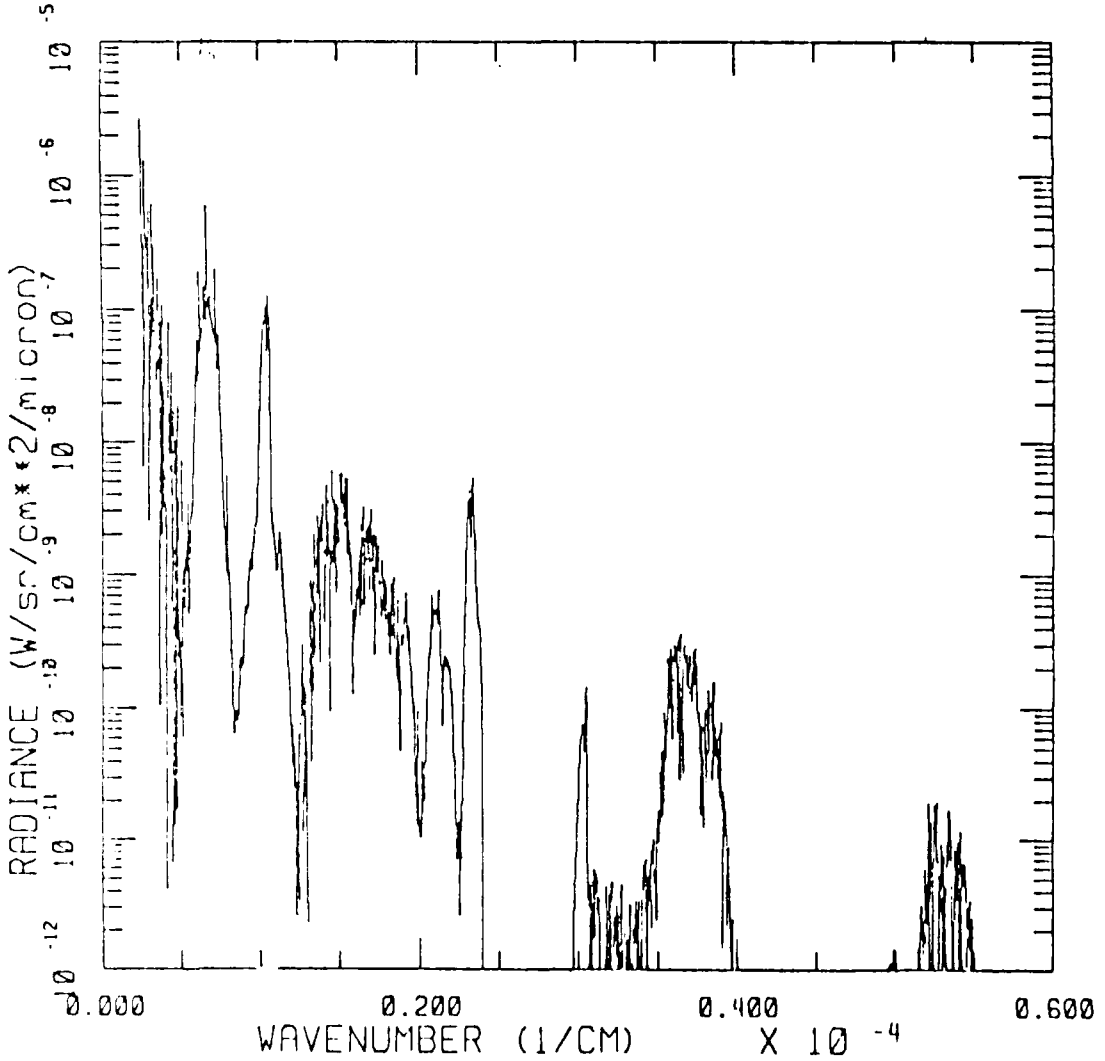
TEST CASE NUMBER 2



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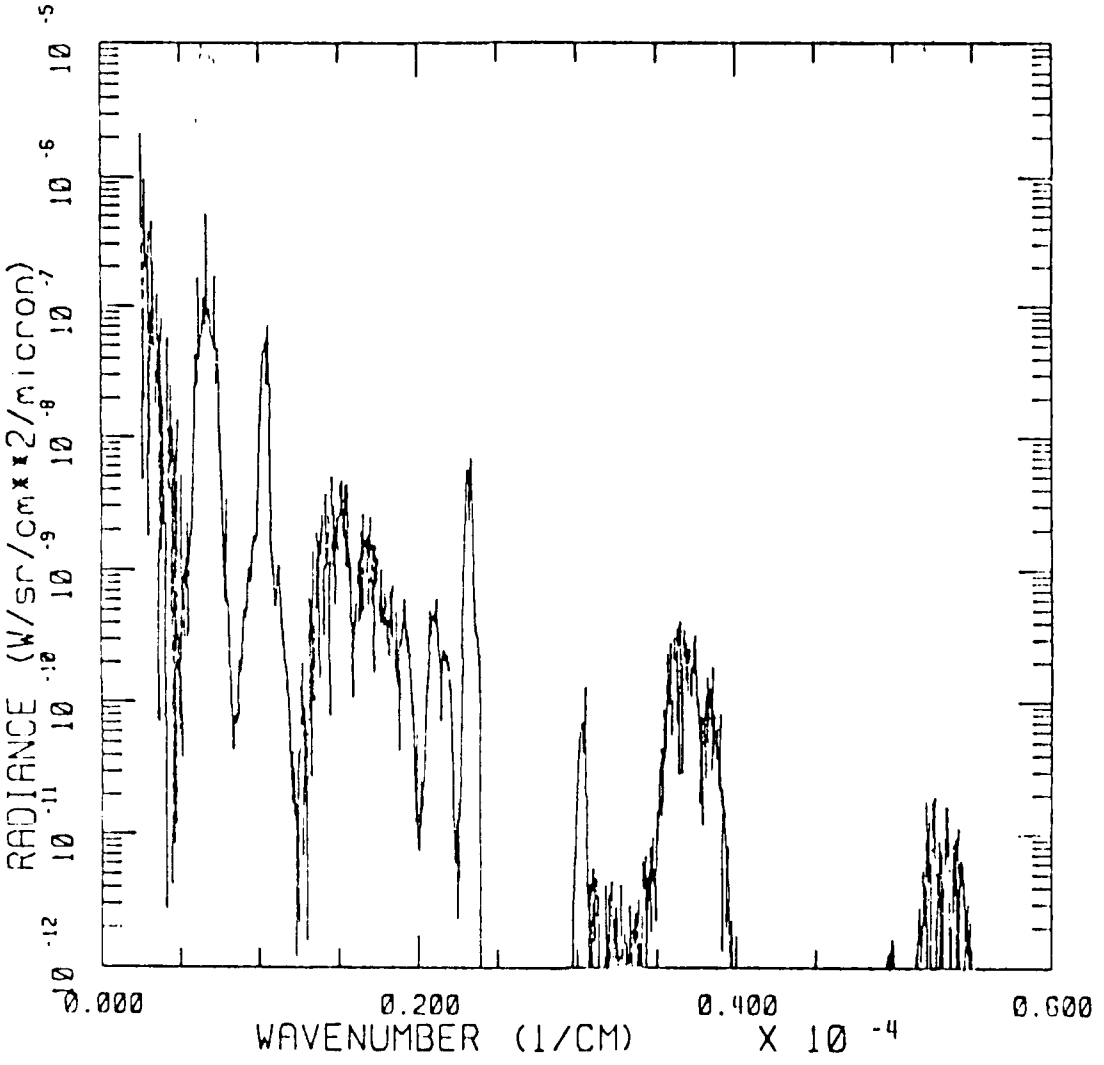
TEST CASE NUMBER 2



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APPENDIX C

HAIRM-87 MAGNETIC TAPE

The magnetic tape is unlabeled, ASCII coded, 1600 BPI and contains the FORTRAN source code, input data sets and two test cases for the High Altitude Infrared Radiance Model, HAIRM. This model calculates the spectral radiance from 250 to 6000 cm^{-1} for altitudes from 60 to 250 km. HAIRM includes radiance from CO_2, H_2O, NO, O_3 and CO.

The tape contains 40 files. There are 8 FORTRAN files, 9 model atmosphere files, 1 band model file, 1 line position and strength file, 1 generic input file, and the input and output from two test cases. The first test case keeps only the two required output files, while the second test case also includes all the optional output files. The last 20 files on the tape are the input and output files from the two test cases. The test cases were run on an Hewlett-Packard 9040, Series 500, minicomputer which has a 32-bit word size.

The tape format is:

9 track
1600 BPI
unlabeled ASCII
40 files
80 characters per record (files 1-20)
132 characters per record (files 21-40)
20 records per block.

The files are:

1	MAIN	Main program	FORTRAN	579 lines
2	MOLE	Molecular routines	FORTRAN	4504 lines
3	BGND9	Radiance routines	FORTRAN	320 lines
4	SPCTRA	Spectral radiance routines	FORTRAN	388 lines
5	TRYPEN	Plotting routines	FORTRAN	348 lines
6	INLIB	Input module routines	FORTRAN	904 lines
7	PROGLIB	Library of routines	FORTRAN	1219 lines
8	PLOTLIB	Library of plotting routines	FORTRAN	415 lines
9	ATM1976.DAT	1976 Standard	DATA	488 lines
10	ATM15AN.DAT	15^{o} Annual	DATA	1464 lines
11	ATM30SM.DAT	30^{o} Summer	DATA	1464 lines
12	ATM30WN.DAT	30^{o} Winter	DATA	1464 lines

13 ATM45SP.DAT	45^{o} Spring/Fall	DATA	1464 lines
14 ATM45SM.DAT	45^{o} Summer	DATA	1464 lines
15 ATM45WN.DAT	45^{o} Winter	DATA	1464 lines
16 ATM60SM.DAT	60^{o} Summer	DATA	1464 lines
17 ATM60WN.DAT	60^{o} Winter	DATA	1464 lines
18 BKNEW.DAT	Band model data	DATA	162 lines
19 LINE.DAT	Line Compilation	DATA	69589 lines
20 DEFLTS	Sample default input file	DATA	105 lines
FIRST TEST CASE			
21 DEFLTS.TS1	Test DEFLTS file	DATA	105 lines
22 INPUT.TS1	Test INPUT file	DATA	405 lines
23 INSPEC.TS1	Test INSPEC file	DATA	13273 lines
24 INPEN.TS1	Test INPEN file	DATA	2880 lines
SECOND TEST CASE			
25 DEFLTS.TS2	Test DEFLTS file	DATA	105 lines
26 INPUT.TS2	Test INPUT file	DATA	405 lines
27 INSPEC.TS2	Test INSPEC file	DATA	13273 lines
28 INPEN.TS2	Test INPEN file	DATA	960 lines
29 OUT2.TS2	Second test case OUT2 output	DATA	9140 lines
30 OUT3.TS2	Second test case OUT3 output	DATA	3242 lines
31 OUT4.TS2	Second test case OUT4 output	DATA	2082 lines
32 OUT6.TS2	Second test case OUT6 output	DATA	9189 lines
33 OUT7.TS2	Second test case OUT7 output	DATA	2184 lines
34 OUT92.TS2	Second test case OUT9.2 output	DATA	1811 lines
35 OUT93.TS2	Second test case OUT9.3 output	DATA	875 lines
36 OUT94.TS2	Second test case OUT9.4 output	DATA	187 lines
37 OUT96.TS2	Second test case OUT9.6 output	DATA	2191 lines
38 OUT97.TS2	Second test case OUT9.7 output	DATA	206 lines
39 OUTSPEC.TS2	Second test case OUTSPEC output	DATA	1216 lines
40 TRYOUT.TS2	Second test case TRYOUT output	DATA	2945 lines

END
DATE
9-88
DTIC